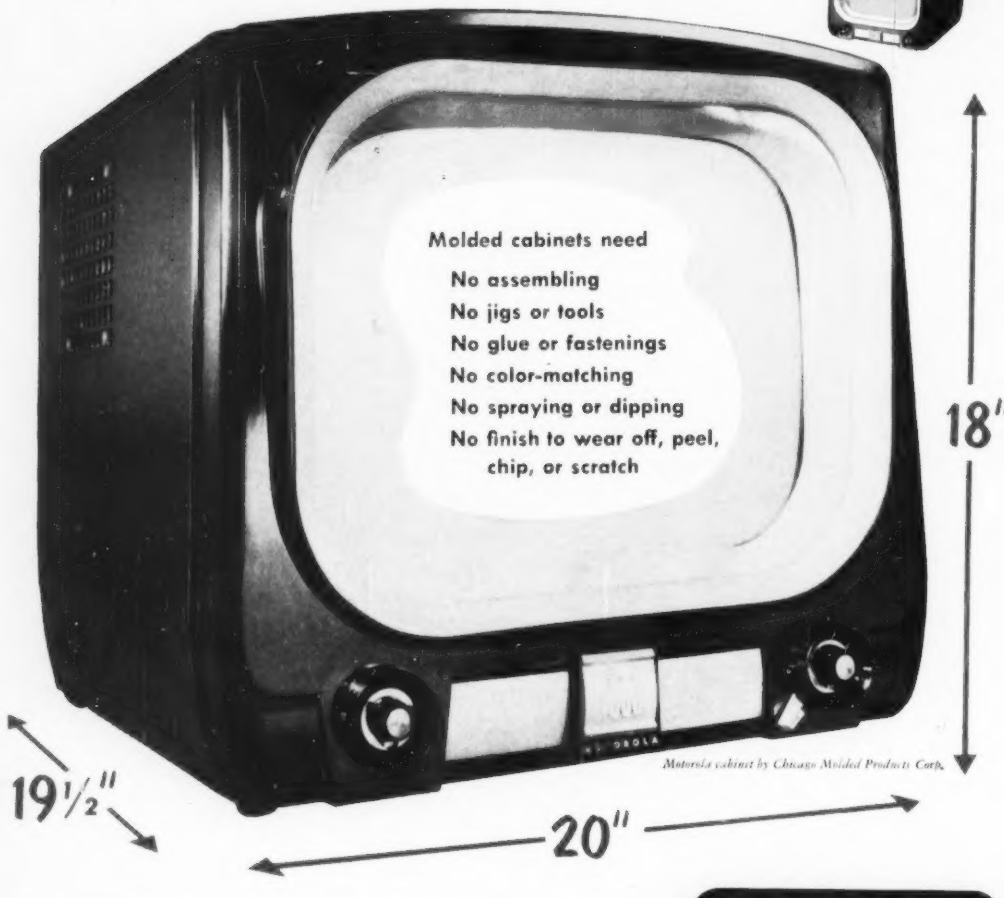
MODERN PLASTICS

SEPTEMBER 1952

Man-Size units in ONE operation



Motorola cabinet by Chicago Molded Products Corp.

...DURET phenolics are in today's big products

● Today you can get one-piece moldings of Durez phenolic much larger even than this housing, giving your products a new appeal to buyers.

In TV sets, record players, air conditioners, and other important house furnishing items, designers, decorators, and the public are coming more and more to appreciate the superiority of phenolic plastics. Their lustrous surface beauty is inherent and permanent, not laid on and subject to wear. They can be given almost any desired structural strength, are highly heat-resistant. Acoustic, electrical, and chemical properties make them superior to other materials in many end-products.

Profitable solutions to some of your *largest problems* may lie in molded Durez units. Talk this over now with your custom molder — or write us.

PHENOLIC PLASTICS THAT FIT THE JOB

DUREZ

PHENOLIC RESINS

MOLDING COMPOUNDS

INDUSTRIAL RESINS

PROTECTIVE COATING RESINS

Our monthly "Durez Plastics News" will keep you informed on industry's uses of Durez. Write, on office letterhead, to

DUREZ PLASTICS & CHEMICALS, INC.

1209 Walck Road, North Tonawanda, N. Y.

MODERN PLASTICS*

VOLUME 30 | SEPTEMBER 1952 | NUMBER 1

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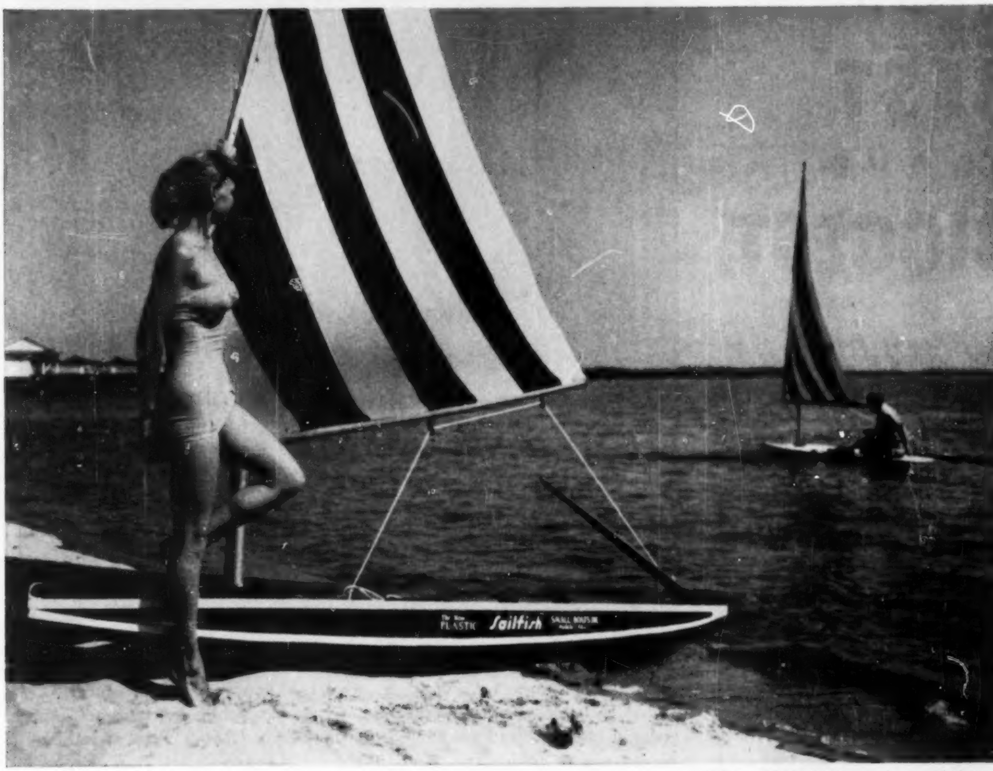
Another new development using

B. F. Goodrich Chemical **raw materials**



B. F. Goodrich Chemical Company does not make these sails. We supply only the Geon resin for the coating.

New Idea for Sails.. New Sales Idea!

THIS is probably something new to you, but those sails are made of Fiberglas coated with a plastisol made with Geon. The sail never needs to be dried. It won't rot, and it resists mildew. Easy to see why the sail manufacturer chose Geon! For any sailing fan knows how important those advantages are—advantages that may steer *you* onto other sales-building ideas.

With Geon materials you get a range of qualities that are ideal for scores of saleable products. For example, Geon is used to make durable flooring . . . handsome draperies . . . delicate fish lures . . . even a rigid material that can be sawed, welded, machined or drilled.

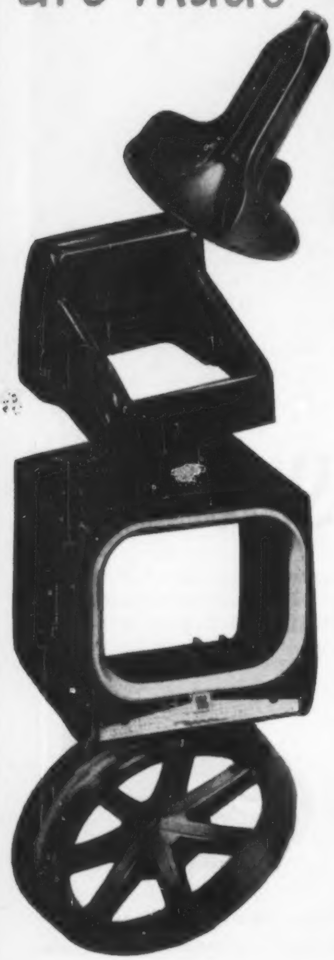
Supplied as resins, latices or compounded plastics, Geon materials make products resistant to heat and cold . . . water . . . weather . . . abrasion and most chemicals. They can be used for coating, molding, casting or dipping. Colors can be brilliant or subdued. With those advantages, you have a head start on developing an idea or improving a product to bring in new sales. We'll help with technical advice. Just write Dept. GA-9, B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, Ohio. In Canada: Kitchener, Ontario. Cable address: Goodchemco.

Geon Polyvinyl Materials

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

Where the BEST OF THE BIGGEST are made



Molding extra large plastics parts in large volume has been an important part of our business for more than 25 years. Thousands of television and radio cabinets, washing machine agitators, machine housings and other parts of unusual size have come from these giant CMPC presses for the biggest names in industry. Many of them were pioneered by Chicago Molded.

This experience in producing large parts has resulted in the development of unusual molding methods and techniques—as valuable to you as to us. It enables us to discard guesswork and to proceed with a sureness based on knowledge . . . to deliver a consistently high quality product in large volume with efficiency and economy. And remember, these factors show up to your advantage in the final cost to you.

With the most modern facilities for molding the largest parts made . . . together with engineers and technicians who have the faculty for understanding your needs . . . plus the ability to get your job into production without delay . . . you'll find this a mighty good place to do business.

Whatever the job . . . large parts or small . . . talk it over with a Chicago Molded engineer. Just write, wire or phone. There's no obligation.

CHICAGO MOLDED

PRODUCTS CORPORATION

CUSTOM MOLDERS OF ALL *Plastics*

1046 NORTH KOLMAR AVENUE

CHICAGO 51, ILLINOIS

EDITORIAL

The Quick And The Dead

An enlightening report on the attitude of manufacturers toward the use of new materials has been published by Standard Factors Corp. under the by-line of its president, Theodore H. Silbert. The survey is in two parts. The first part covers the present position and attitude of 726 manufacturers toward new and alternate materials, and the gist of it is that the introduction of new materials seems to be accepted only slowly by manufacturers and, regrettably, only under the duress of supply shortages, economics, and activities of the competition.

Apparently there is a sharp dividing line in attitude towards and method of materials selection, between manufacturers with 150 employees or less and the larger firms, the small companies having no planned procedure for study and evaluation of new or alternate materials. On new products and new materials, only 13.4% of the smaller manufacturers surveyed received outside professional service or advice. And of this group, 17.6% got its information from suppliers, 47.1% from trade and industrial publications and trade associations, 5.9% from public sources such as Government reports, and 17.6% from laboratory research aid.

The place of the business press and the trade associations in this picture is significant and encouraging. The smaller percentage of manufacturers who received information on new products and new materials from suppliers would seem to be a serious matter, and worth some study on the part of suppliers. More serious is the fact that only 3.3% of the manufacturers surveyed have any established routine for the study and evaluation of new methods, materials, and products.

The factoring company further studied the experience of 1963 manufacturers in the period from 1945 through 1948 with the use of new or alternate materials. This second portion of the survey indicates that manufacturers who did not put enough study and research into the selection of new and alternate materials, as well as those who refused to experiment with new materials, often suffered losses and slipped badly in their market position. It was also found that manufacturers who evaluated new and alternate materials *well in advance* of their need for them had a far better chance of retaining their markets than producers who waited too long and then seized upon any new or alternate material and presented their unprepared markets with products which were often unsatisfactory.

We think there is a big and important point here.

Too many manufacturers will not study up on materials and methods that common sense must tell them they will be using a year or two years or five years from now. To such men, bitter is the day when, all unprepared, they must finally switch to a new material and a new method, because of the aforementioned duress of supply conditions, cost economics, or the activities of the competition.

But for those who can foresee grand things to be done and profits to be made from new materials, well in advance of the time when they may expect to use those new materials in their products, there is the great likelihood that they can lower their costs, improve their products, and increase their sales.

The difference in commercial success between these two types of management in the manufacturing industry—the man who won't adopt new materials until he has to, and then does so ineptly, and the man who makes a steady study of new materials against the possibility of his later use of them—is often, this survey proves, the difference between the quick and the dead.

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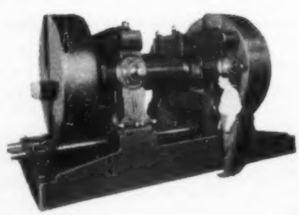

Our experienced and highly specialized engineering organization makes available to you the combined abilities of many minds for assistance in solving problems relating to machinery and processes for the manufacture of rubber or plastics products. Close cooperation with the rubber and plastics industries, and a consistently maintained research program, have enabled us to pioneer many revolutionary processes and improvements in basic manufacturing equipment.

When your plans call for the installation of single units or for the setting up of complete processing trains with all accessories, consult us. Designing processes and machinery to meet unusual product requirements has been our business for over 60 years.

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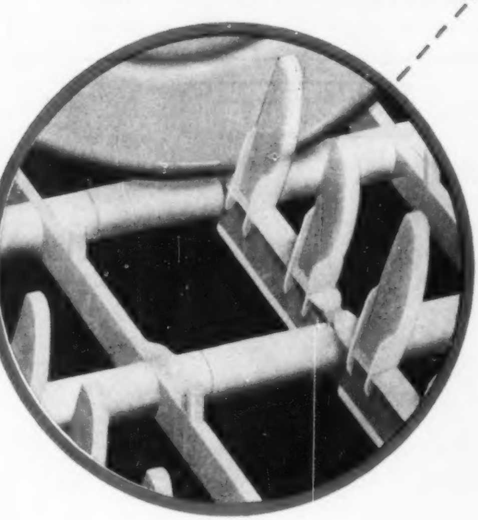
Branch Offices located in Principal Cities

Subsidiary of United Engineering and Foundry Company • Plants at Pittsburgh, Vandergrift, New Castle, Youngstown, Canton

Dishwasher conveyor molded of Du Pont nylon plastic



Parts molded by
Hauser Products, Inc., Chicago
for G. S. Blakeslee & Co., Chicago

withstands caustic detergents and scalding water...won't chip or scratch china and glassware

A manufacturer of dishwashing machines decided to apply the assembly-line technique of mass production to washing dishes. His engineers designed a machine with a conveyor that carried the dishes under a hood where they are sprayed first with fresh water to wash off loose food, then with a detergent solution to dissolve grease, rinsed, sterilized with scalding water and air-dried. The problem was finding a material for the dish conveyor that would stand up under these conditions, yet not chip or scratch the dishes.

The answer proved to be injection-molded parts of Du Pont nylon that fit on brass tie rods so that no metal touches the dishes. The parts link together to form a continuous belt of "fingers" that support the dishes.

Every step of the way Du Pont nylon is excellent for the job. Because nylon is resilient, it will not scratch or chip china and glassware. Yet nylon is tough and virtually unbreakable in normal use. It withstands food acids, caustic detergent solutions and temperatures up to 250°F. The conveyor tie rods are fitted with molded nylon rollers which are adequately lubricated by water or detergent solutions—either of which would make the use of conventional lubricants almost impossible.

Perhaps the many valuable properties of Du Pont nylon plastic can help you improve or develop a product. For further information on nylon and other Du Pont plastics, write:

DU PONT

150th Anniversary

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. . . through Chemistry

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PLASTICS • CHEMICALS

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ask for Acetate Plastic

FABRICATED BY
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PHILADELPHIA, PA.

Whenever point-of-purchase advertising calls for realistic product reproduction, display men ask for Celanese* acetate sheeting. This tough versatile plastic shows excellent heat resistance to store window temperatures . . . has less dust-collecting static . . . is one of the easiest materials to work with.

It can be heat formed, drawn, cemented, silk screened or printed . . . available in opaque, translucent and transparent colors as well as clear transparent. Celanese acetate can also be metalized, coated or supplied in a variety of surface finishes.

A Celanese representative can give you complete facts on acetate for display and other promotional material.

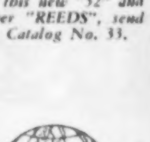
Celanese Corporation of America, Plastics Division, Dept. 101-I, 180 Madison Avenue, New York 16, N. Y.

In Canada, Canadian Chemical & Cellulose Company, Ltd., Montreal and Toronto.

Celanese*
Acetate SHEETING

*Reg. U. S. Pat. Off.

53 oz. KRISPER molded on 32 oz. "REED"



You wouldn't think it possible but it's actually being done! A new 600T-32 oz. Reed-Prentice Plastic Injection Machine is molding a 53 oz. Norge krisper at Michigan Plastic Products, Inc., Grand Haven, Michigan.

On jobs like this the 600 tons locking pressure, greater plasticizing capactity and large die plates of the rugged 32 oz. "REED" are really appreciated.

To get the full details on this new "32" and other "REEDS", send for Catalog No. 33.

SPECIFICATIONS:	32 oz.
Die locking pressure, tons	600
Rated Casting area, sq. in.	300
Mold opens	24"
Max. die space	28"
Size of plates	45x54"
Weight, lbs.	46, 100

THE WORLD'S LARGEST MANUFACTURERS OF INJECTION MOLDING MACHINES

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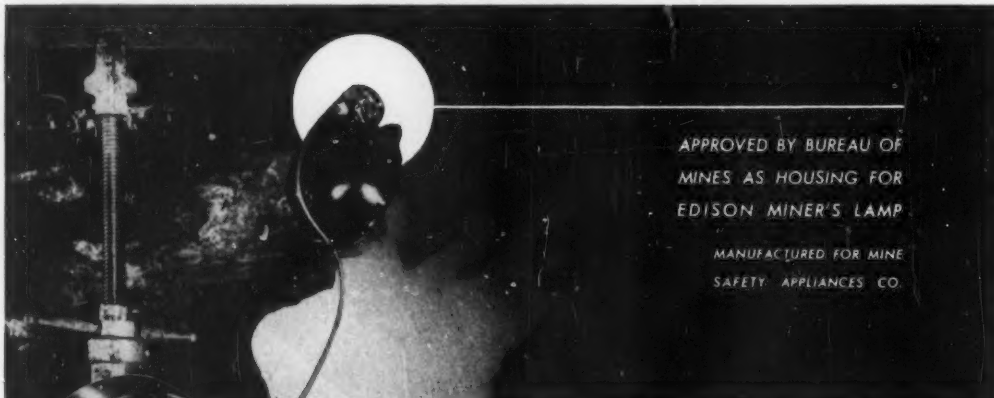
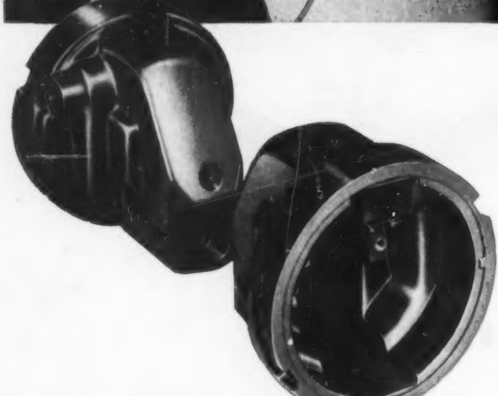
ROGERS CORP. Impact Phenolic Specified for RUGGED DUTY





AN ESSENTIAL TOOL in underground operations, a miner's lamp must be rugged. It will be bumped, struck by dislodged pieces of coal and exposed to the action of corrosive mine water. The housing must stand up under these rugged conditions.

Rogers impact phenolic molding compound RX 428 is specified for this rugged assignment. It's tough, dimensionally stable and resistant to acids. In addition, it provides the efficient molding characteristics required of a plastics part that must be molded to tolerances of plus and minus .005".

For plastics parts with rugged assignments, investigate the wide range of Rogers preformable impact phenolics.

Please Write For Data Sheets on Rogers Impact Phenolic Molding Materials

Dept. P, Rogers Corporation, Manchester, Conn.

ROGERS CORPORATION
Established in 1832

DUROIDS	ELECTRICAL INSULATION	PLASTICS	SHOE MATERIALS	FABRICATING
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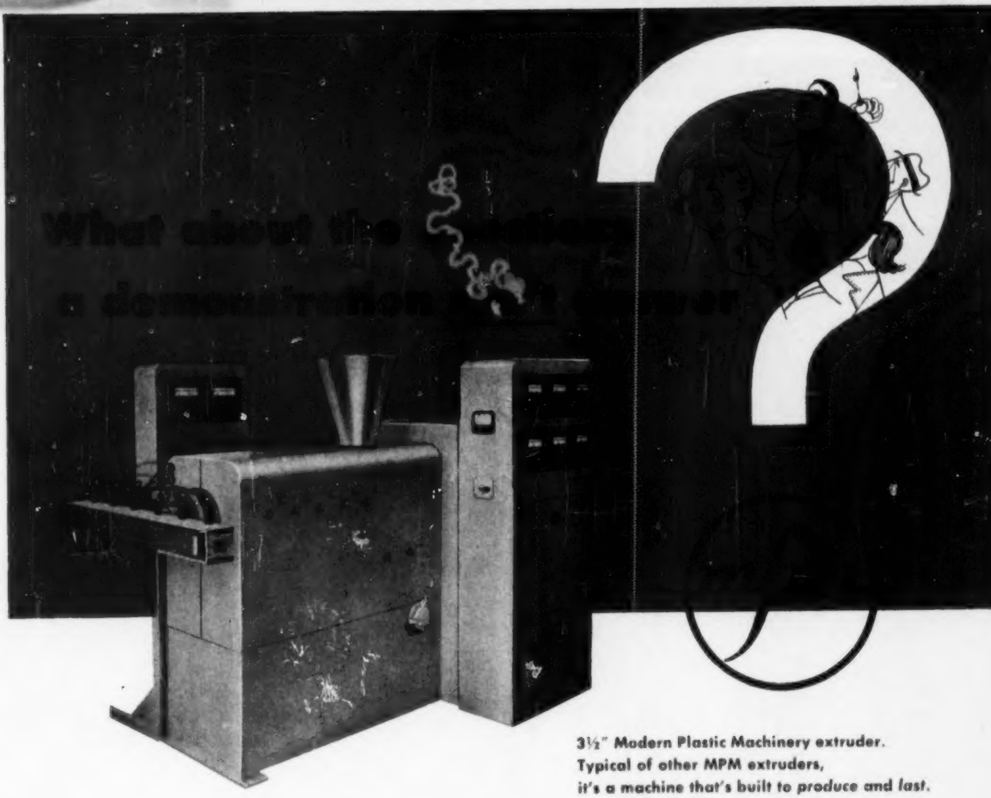
What about the questions a demonstration can't answer



3½" Modern Plastic Machinery extruder.
Typical of other MPM extruders,
it's a machine that's built to *produce* and *last*.

AT A DEMONSTRATION of a shiny new extruder everybody expects A-1 performance. After all, the machine is brand new, tuned to perfection, working under ideal conditions and operated by factory experts.

But what happens after *you* have been running the extruder for a while? What happens after six months? A year? That's when you really can judge what you've bought. That's when you begin to appreciate the otherwise hidden extras given you by MPM.

Here are a few of the questions which a demonstration can't answer and which you *won't* have to worry about if the extruder you select is an MPM: *Will my extruder be able to extrude new materials with new extrusion characteristics?* The MPM heat control system is so versatile that these machines are used for experimental extrusion work in the development laboratories of nearly every major material supplier. *What about abrasion resistance and internal wearing qualities?* All parts of MPM extruders that contact plastic resins, from hoppers to die-heads, are constructed of solid corrosion and abrasion resistant materials. No platings of hard metals over soft are used; therefore the "wear-through" problem is reduced. *Can my extruder produce a wide range of products?* The combination of MPM's unique heat control, superior die-head and screw design, vari-speed drive and indicating tachometer gives you the widest production range. You can produce precision rods, tubes, cross-sections, covered wire, and wide blown film. The mixing action of the MPM extruder provides an efficient means of compounding and coloring numerous plastic formulations. The MPM pelletizing machine cuts the compounded materials into uniform cylindrical pellets for molding or extrusion.

Of course, there are many pertinent questions about MPM extruders that a visit to our plant *will* answer. Or if you prefer, write for further details.

California Representative:
WEST COAST PLASTICS DISTRIBUTORS, INC.
4113 W. Jefferson Blvd., Los Angeles 13, Cal.

modern plastic machinery corp.
15 Union St., Lodi, N. J., U. S. A.
Cable Address: MODPLASEX

for the Refrigeration Industry

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Refrigerator manufacturers have learned that Erie . . . the pioneer in custom injection molded plastics . . . is a dependable source of supply, whether it's for large parts that must be crystal clear, free from flaws, and proof against warpage; for functional parts that must be meticulously accurate in dimensions; or for sparkling, jewel-brilliant marks of identification in three dimensional plastics.

Write for your copy of bulletin, "Who We Are . . . What We Do in Plastics."

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Midget


Laboratory No. 251

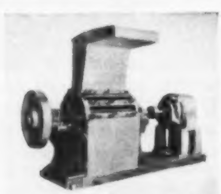

Standard Ideal


Heavy Duty Ideal

Whether you call it a GRANULATOR, CUTTER, GRINDER or PULVERIZER...

Ball & Jewell has a model and size to meet every production capacity, from 50 to 3,000 pounds per hour. So send us your specifications, and we will recommend the specific machine best designed to serve your production needs.


No. ½ T.D.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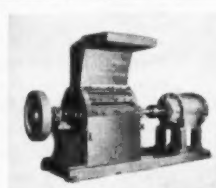
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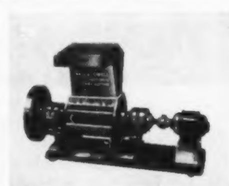
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No. 2½


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POLYSTYRENE MOULDING POWDERS
THE Versatile PLASTIC
No need to state the virtues of polystyrene. It is accepted all over the world for its versatility . . . its adaptability. At long last the designer has been given a moulding powder reasonably free from limitations.
No need either to state the virtues of Kleestron. Enough to say it is made by Kleemann's in their new factory at Welwyn Garden City and is being sold . . . and moulded . . . and praised all over the world.
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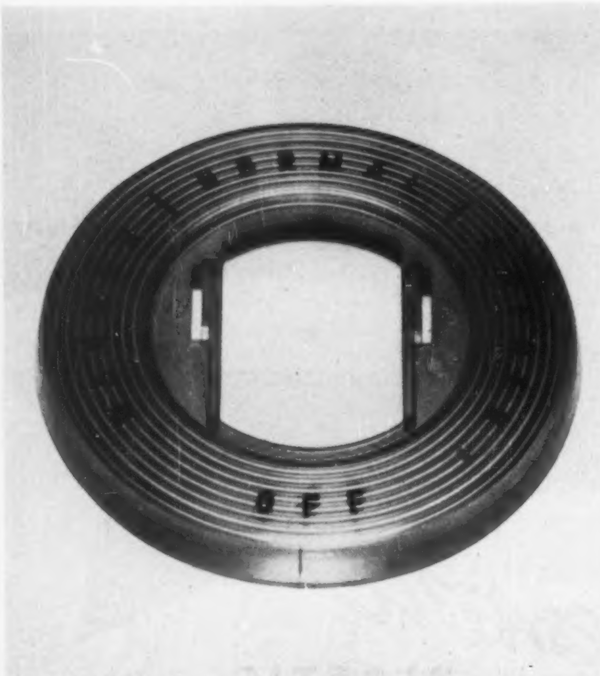

PLASTIC FOR INDUSTRY

Illustrated are two decorative plastic pieces currently being molded for the Midwest Manufacturing Company, Galesburg, Illinois, for the Admiral refrigerator. The parts are produced in polystyrene and decorated.

Our facilities are available for the production of large refrigeration components such as evaporator doors, breaker strips, door baskets, trims etc. We have capacity of up to 60 ounces and complete finishing facilities for all type of decorative work. Your inquiries are welcome and our engineers are at your service for consultation at all times.

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Manufacturing Company

2460 W. JACKSON BLVD. CHICAGO 12, ILLINOIS

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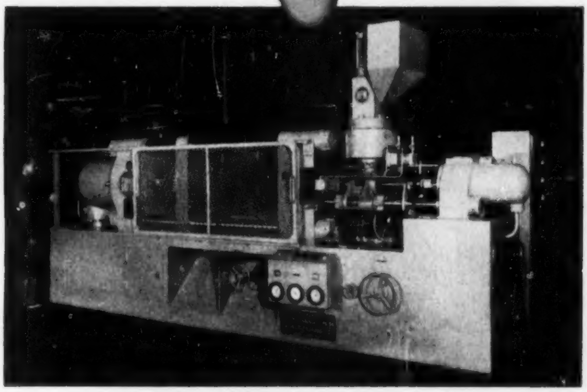
Just Out!

H-P-M's new 48 oz. Pre-Plasticizer



NEW H-P-M MODEL 400-P-48 offers 25½" x 36" mold space; 54" daylight; 30" clamp stroke and 48 oz. Inj. capacity.

• H-P-M's new 48 oz. pre-plasticizing injection machine has just been put in operation! Not a conversion unit . . . the new H-P-M 400-P-48 is designed from scratch, especially for pre-plasticizing. It's the only machine which offers you . . .

- Faster plasticizing rates
- Lower injection and clamping pressures
- Strain-free parts
- Better color dispersion for dry coloring
- Less part distortion
- Lower molding temperatures
- Weight-savings up to 10% on each part

The 400-P-48 produces exceptionally deep parts up to 14 inches in depth. And, with the quickly installed ram spacer is also ideally suited for shallow parts.

Remember, the new H-P-M 48 oz. pre-plasticizer costs thousands of dollars less than a conventional machine and you get all of the advantages of pre-plasticizing. Stock machines available. Write for full details, today!

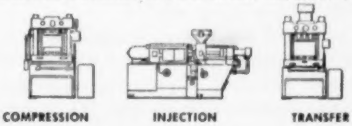
75th YEAR

HPM

THE HYDRAULIC PRESS MFG. CO.

1010 MARION RD., MOUNT GILEAD, OHIO, U.S.A.

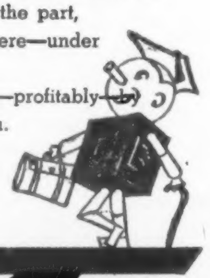
PLASTICS MACHINES FOR EVERY MOLDING JOB



COMPRESSION INJECTION TRANSFER

IF YOUR PROBLEM IS PLASTICS . . .

Call Cubee



Here's a

New Idea

Worth Trying!

As little as 3% Magnesol*

Powdered Industrial Grade,

mixed with phenolic molding powder

- **Promotes Cure**
- **Reduces Blistering and Pimpling**
- **Improves Dimensional Stability During Cooling Interval**
- **Facilitates Mold Release**

You have everything to gain—and nothing to lose—by finding out how much just a little MAGNESOL BRAND Adsorptive Magnesium Silicate, Powdered Industrial Grade, can improve your phenolic moldings.

Being a highly-adsorptive, non-reactive, inorganic powder, MAGNESOL is an excellent flow promoter. Its finely-divided structure imparts a "slippy" coating to particles of phenolic molding powder . . . makes it easier to handle. In the mold, MAGNESOL adsorbs gases, moisture, and other impurities that cause blistering and retard cure. It also improves the dimensional stability of the hot, newly-formed solid, thus preventing warp or distortion during the cooling period and thereby facilitating mold release. As a detackifier and filler, it adds much . . . *yet costs less than the molding powder its volume replaces.*

SEND FOR TECHNICAL DATA SHEET S-100

The first step towards finding out what MAGNESOL can do is to send for Technical Data Sheet S-100 now. We'll then arrange to send you an experimental sample so you can check MAGNESOL's performance in a plant test.

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FOOD MACHINERY AND CHEMICAL CORPORATION
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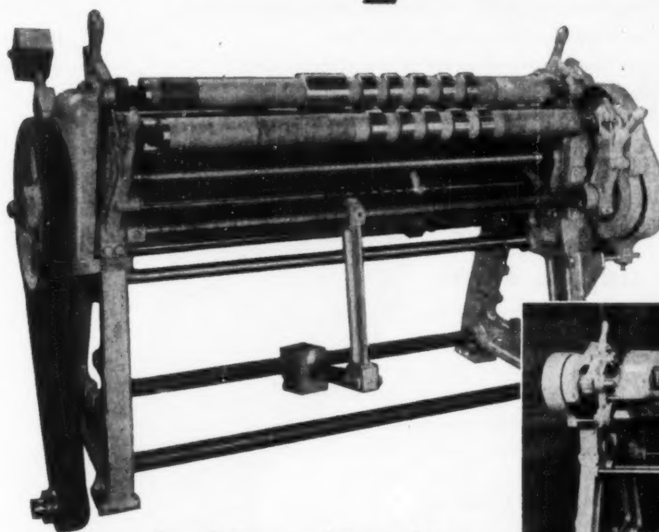
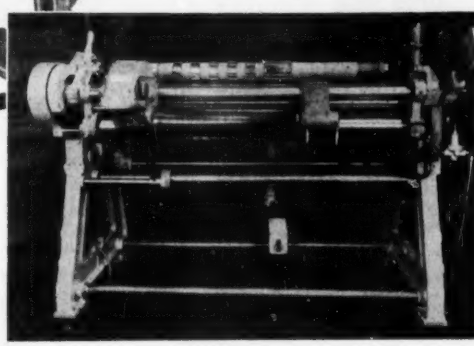
Taming a 2-way stretch!

with CAMACHINE 26-R-7



Rear view showing 10" dia. capacity integral mill roll apparatus. Larger mill roll capacity can be supplied.

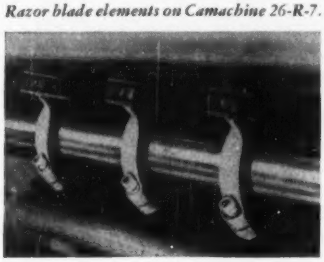


A standard Camachine slitter using razor blade slitting on light gauge plastic film

Model 26-R-7 is another successful application of the Camachine *modified standard* idea to the problem of plastic film roll production—in this case a light gauge material with 2-way stretch.

To assure positive roll separation, the new slitter employs the standard Camachine Type 26 dual rewind shaft arrangement, with rewound rolls alternately staggered on the two shafts.

Razor blade elements on Camachine 26-R-7.



The rewind shafts are gear driven and are equipped with adjustable slip friction clutches. The 26-R-7 may be operated center rewind or combination surface and center rewind, using the differential principle for sensitive, automatic tension control on the strips.

The integral shaftless mill roll apparatus, equipped with pneumatic chucks, is one important modification of the standard design to suit the material. Positive tension is maintained on the web by means of an electrically operated brake controlled by a rheostat.

Another design modification is the use of razor type slitting elements which can be quickly replaced or respaced to a minimum strip width of ¾" (or narrower with special slitter units). Blade edges align with grooves in the platen roll. The web is firmly supported on the platen roll as the slit is made.

Camachine 26-R-7 has successfully slit a wide variety of plastic films down to .00025 gauge at speeds up to 700 fpm. For complete information write for Catalog Supplement 1010-C.

While design modifications suit the slitter to the special characteristics of the material, the use of the standard basic Camachine Type 26 assures ready interchangeability of parts, plus the reliable backing of a well-stocked repair parts service. These two vitally important service factors help to hold downtime to a minimum through years of low-cost operation.

What the Camachine *modified standard* idea has done for this 2-way stretch it can do to answer other problems in top-quality roll production for the plastics industry. You are invited to consult with Camachine engineers.

CAMERON MACHINE COMPANY · 61 Poplar Street · Brooklyn 2, N.Y.

LOOK FOR THE BEST WAY TO DO IT AND YOU'LL WIND UP WITH *Camachines*®

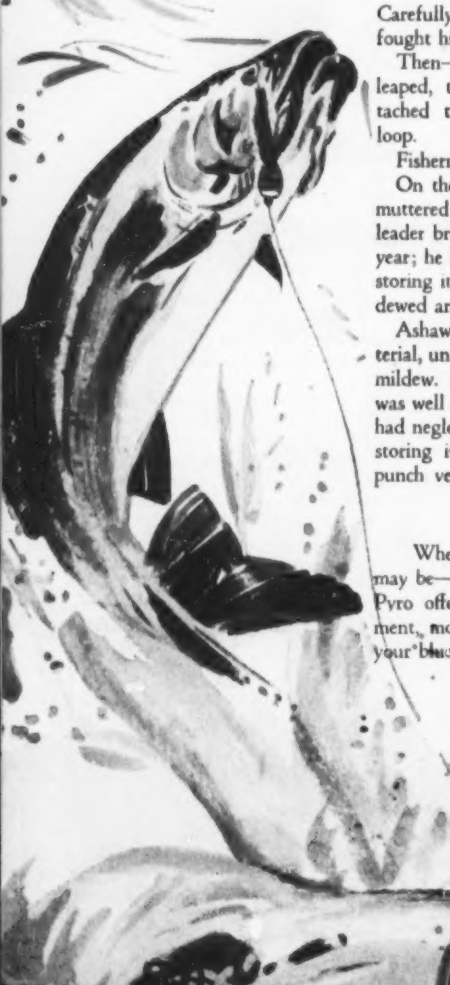
AA-262

AN ANGRY ENGINEER PLAYED THE LEADING ROLE IN *The Case of the*

Frantic Fisherman

A TRUE STORY BY

"Ellery Queen"



THE fisherman poised the rod and cast. A strike! The fish leaped high and, turning, raced with the line.

Straining against the pull, the fisherman played out line, took up slack, as the battle raged back and forth across the pond.

At last the "big one" began to tire. Carefully, inch-by-inch, the fisherman fought him to within reach of the net.

Then—disaster! The "big one" leaped, the rod bent, the leader attached to the line snapped at the loop.

Fisherman's "luck"—be hanged!

On the way home, he growled and muttered and fumed. Why had that leader broken? It was brand new last year; he had used it only once before storing it over the winter. Had it mildewed and rotted?

Ashaway flylines and leader material, under ordinary conditions, resist mildew. As an Ashaway executive, he was well aware of that. Yet maybe he had neglected to dry the leader before storing it. Or had he forgotten to punch ventilation holes in the lid of that old cracker tin? He'd never know, for he had tossed away the tin that morning.

As he drove along, an idea took shape. And it was *that* idea which led him to the offices of Pyro Plastics Corporation.

Pyro was producing the plastic spools which hold the Ashaway fishing lines. Why couldn't these spools be packaged in durable plastic boxes to serve a double purpose: To enhance the product's display appeal, and to be used, when empty, as a leader box, dry fly box, etc.? Punch-out holes in the lid would supply the needed ventilation to allow leaders to dry without mildew.

A first-rate idea! Point is, could a way be found to produce the boxes economically?

Pyro's skill, experience, extensive facilities, special equipment and custom machinery were put to work. As a result the Ashaway plastic boxes today meet the highest demands of a top quality product.

Successfully, Pryo closed the Case of the Frantic Fisherman.

☆ ☆ ☆

When *your* plans call for thermoplastics—however complex your problems may be—call in Pyro engineers for help. Pioneers in custom injection molding, Pyro offers complete services: Consultation and design, research and development, molding and engineering. Estimates submitted promptly upon receipt of your blueprints and specification.

STARTING POINT FOR A BETTER PRODUCT

Pyro PLASTICS CORPORATION
PYRO PARK, UNION, NEW JERSEY


RICO
TOMASO

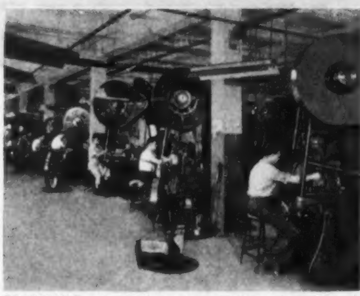
MANUFACTURERS WHO INSIST ON FINE CUSTOM MOLDING

ALWAYS CHOOSE

Santay

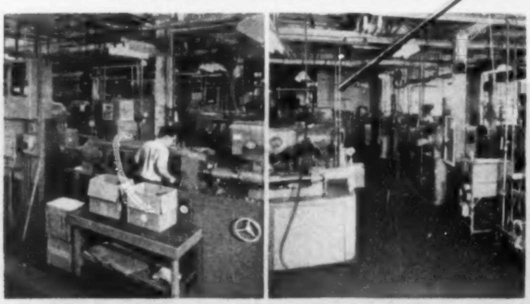
TOOLING — Santay makes all of their own molds — dies — tools and fixtures . . . for both plastic and metal divisions.

ENGINEERING — Santay has complete engineering facilities. They work closely with the manufacturers' engineers to design the product and for economy in molding . . . based on over 30 years of experience.



STAMPING — Santay has a completely equipped Punch Press Department ranging from high speed automatic Diebel to automatic feeds on 85 ton press equipment. It also has secondary metal working equipment-spot welding — rolling — burnishing.

355 NORTH CRAWFORD AVE., CHICAGO 24, ILLINOIS **TELEPHONE SAcramento 2-2900**



MOLDING — Santay has a complete range of presses to mold from 2 oz. to 60 oz. shots in every type of thermoplastic material.

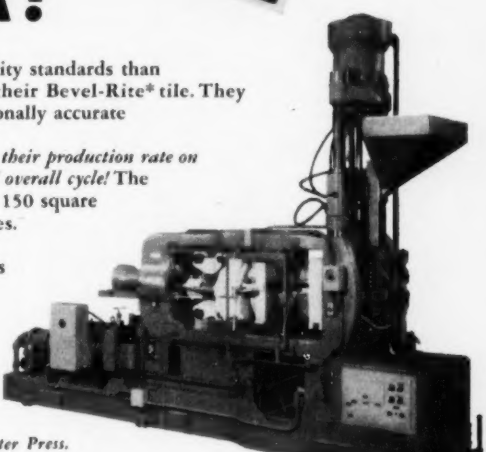
One look inside the 110,000 square foot SANTAY Plant will show you why it's the choice of manufacturers from coast-to-coast. The modern up-to-the-minute equipment combined with a complete staff of highly skilled personnel assures you FINE CUSTOM MOLDING with a maximum of efficiency and economy.

Write or phone today for the name of the SANTAY representative nearest you. If you insist on CUSTOM MOLDING at its best then you will always choose SANTAY.

ASSEMBLY — Santay has a complete Assembly Department. Here the manufacturer has the opportunity of having his product completely assembled, ready for shipment.

FINISHING — Santay has both hand and fully automatic painting facilities including the making of their own masks. This department is conveyorized for efficient operation.

on a 20 oz. LESTER!



No tile molder in the country has higher quality standards than Plastic Engineering, Inc., in Cleveland has for their Bevel-Rite* tile. They demand and get strong, warp-free, clean, dimensionally accurate tile with a unique "cloud pattern" marbleization.

Yet, in spite of these rigid standards of quality, *their production rate on an L-3-15-20 ounce Lester is a phenomenal 18 second overall cycle!* The shot is eight cavities of 4-1/4 x 4-1/4 beveled tile, 150 square inches of projected area, weighing 6-1/2 ounces.

The L-3-15-20 ounce Lester, with its high speed toggle and enormous plasticizing capacity, provides every advantage for low-cost, high-quality tile molding. Our customers know that for *any* fine molding, they can count on their Lesters. Complete specifications on the machine of your choice is available on request.

*T. M. REG.

Write for your free copy of the Lester Press.

LESTER INJECTION MOLDING MACHINES

distributed by LESTER-PHOENIX, INC., 2621-B CHURCH AVENUE • CLEVELAND 13, OHIO

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Invitation

No sane molder ever actually issues an invitation like this, but invitation or no invitation, sometimes when you hook up with the wrong source of supply, round and round you go – in lovely circles. You go round and round on design; you go round and round on material selection; and Boy, do you go round and round on delivery!

In the thirty-plus years that Boonton has been in the custom molding business, we have always done our darndest to keep each customer going straight . . . straight toward his objective of a perfectly molded product, delivered to him on time, and at a price that won't force him to mortgage the old family homestead.

True, we've made a few mistakes, but we can honestly boast, "Never the same mistake twice." Since the best of our errors are behind us, why not drop in to discuss your next molding job. We're nice people, cooperative as a couple of monkeys picking fleas from each other . . . and there isn't a merry-go-round in miles.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE — CHANIN BUILDING, 122 EAST 42ND STREET, MURRAY HILL 6-8540

A NEW 

ASSEMBLY PLANNING AID

FOR DESIGN, PROJECT, STANDARDS, AND METHODS ENGINEERS, AND PRODUCTION OFFICIALS CONCERNED WITH ASSEMBLY

The PARKER-KALON ENGINEERING STANDARDS BOOK

Here is the assembly planning reference book you've been waiting for. Already thousands of requests for it have been received. Making sure it contained *all* the information you want took somewhat more time than anticipated, but your copy is ready now.

This new edition is set up to help you find the facts and figures you need faster than ever. It gives complete head and thread dimensions on all P-K standard screws, and many specials. It's also packed with other useful information.

Send for your copy. Look it over. You'll see why the many types in the complete P-K line of Self-tapping Screws enable you to *fit the right fastener* to the job, not fit the *job* to some one type of *fastener*.

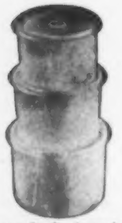
It's available to all authorized assembly planners. Send your request on your company letterhead. Write today. Parker-Kalon Corporation, 200 Varick St., New York 14.

PARKER-KALON®

The Original SELF-TAPPING SCREWS

Cold-forged SOCKET SCREWS

AND OTHER FASTENING DEVICES

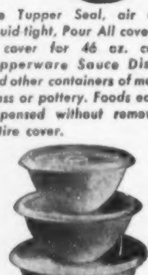


Tupper Seal, air and liquid tight flexible covers fit, and are included in the sets of all Tupperware Canisters.

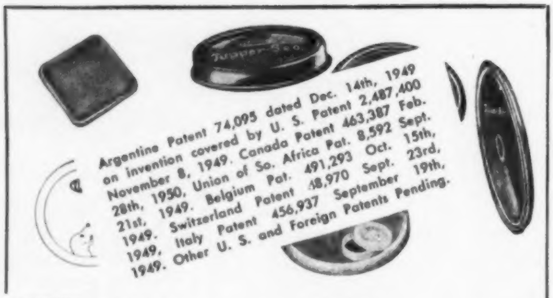
The Tupperware 50 oz. Canister is "standard equipped" with the Tupper Seal, air and liquid-tight flexible Pour All cover.

The Tupper Seal, air and liquid-tight flexible Pour All cover is used on every Tupperware 20 oz. Canister.

The Tupper Seal, air and liquid-tight, Pour All cover as a cover for 46 oz. cans; Tupperware Sauce Dishes and other containers of metal, glass or pottery. Foods easily dispensed without removing entire cover.

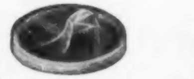


The Tupperware Wonder Bowls are usually fitted with Tupper Seal, air and liquid-tight covers.

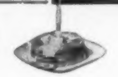


TUPPER! Seals

air and liquid-tight, flexible covers for Tupperware Tumblers, Canisters, Wonder Bowls, Cereal Bowls and many another container of glass, metal and pottery, the contents of which it is desired to keep fresh and wholesome.



TUPPER!



FORMAL NOTICE! 9th November, 1949

EXCLUSIVE!

U. S. Patent #2,487,400

The Tupper Corporation has attained a position of leadership in this industry by incurring great expense and expending painstaking effort in the development, design, manufacture and exploitation of its many world-known products.

The Tupper Corporation further has anticipated the inevitable attacks to which leadership is subject and has taken measures provided by law to preserve the creative rights to its products, methods and design by patent protection both in the United States and abroad.

Tupper Seals for Tupperware shown in this advertisement are just a few of the forms covered in this manner and are specifically covered by U.S. Patent #2,487,400.

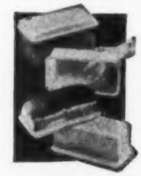
Only the Tupper Corporation, by U.S.Patent #2,487,400 has the right to make, use and vend container closures in connection with any and all types of containers throughout the United States and its territories as covered by the claims of the Patent.

Tupper Corporation will protect, according to law, the exclusive rights above granted

TUPPER CORPORATION

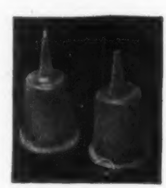
There's a Tupper Seal, air and liquid-tight flexible cover for Tupperware 2, 5, 8 and 12½ oz. Tumblers too, and these Tupper Seal, covers fit many other containers of metal, glass and crockery.

The Tupper Seal, air and liquid-tight flexible Por Top cover, specially designed as a dispensing cover for specified diameters of containers holding foods such as syrups, salad dressings, catsup.



The cover of the Tupperware Bread Server which serves as a bread tray also is designed to give similar results as Tupper Seal, air and liquid-tight Flexible covers. Keeps contents fresh as no other such container.

When equipped with Tupper Seal, air and liquid-tight, flexible covers, Tupperware Cereal Bowls serve many another purpose.



The Tupper Seal, air and liquid-tight flexible cover made for Tupperware 8 oz. Tumblers also fits and is sold with all Tupperware Funnels as a base when funnels are used as storage containers.

TUPPER CORPORATION

TUPPER

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

FACTORIES: Farnumsville, Mass., and Cuero, Texas **New York Show Rooms 225 Fifth Ave.**

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If you're looking for a good general purpose stabilizer

1. Excellent heat and light stability: Dythal's high available basic lead content assures heat stability in processing. Its excellent ultra-violet light absorption makes for improved light stability in your finished product. It provides low tinting strength, and thus helps make bright colors possible.

...look to "Dutch Boy" DYTHAL

"Dutch Boy" Stabilizers

PRODUCT	USE
TRIBASE (Tribasic Lead Sulphate)	Electrical and other compounds requiring high heat-stability
TRIBASE E (Basic Lead Silicate Sulphate Complex)	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
PLUMB-O-SIL C (Co-precipitate of Lead Orthosilicate and Silica Gel)	Highly translucent film and sheeting
DYTHAL (Di-basic Lead Phthalate)	General purpose stabilizer for heat and light. Good electrical properties
DYPHOS (Di-basic Lead Phosphite)	Outstanding for heat and light in all opaque stocks, including plastisols and organosols
NORMASAL (Normal Lead Salicylate)	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light-stability
BARINAC (Barium Ricinoleate)	Stabilizer-lubricant for clears

2. Good electrical properties: Dythal is particularly effective when used in high temperature insulation compounds.

3. Even dispersion, low volume cost: Dythal disperses uniformly throughout ... gives excellent results in film and sheeting, in extrusions (especially on wire), and in plastisols. If you want to extend the life of your plastic compounds, investigate "Dutch Boy" Dythal, general purpose stabilizer. Consult our technical staff for additional information and data. Write today.

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NATIONAL LEAD COMPANY
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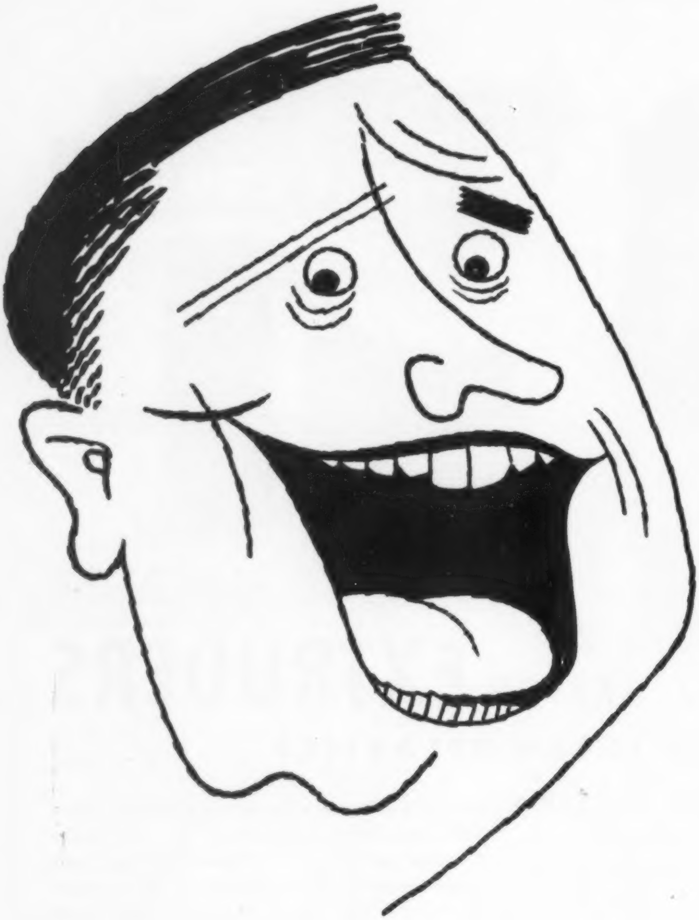

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WHEN YOU CALL ON BRIDGEPORT MOULDED FOR COMPLETE PLASTIC MOULDING SERVICE

BPM Bridgeport Moulded Products, Inc.

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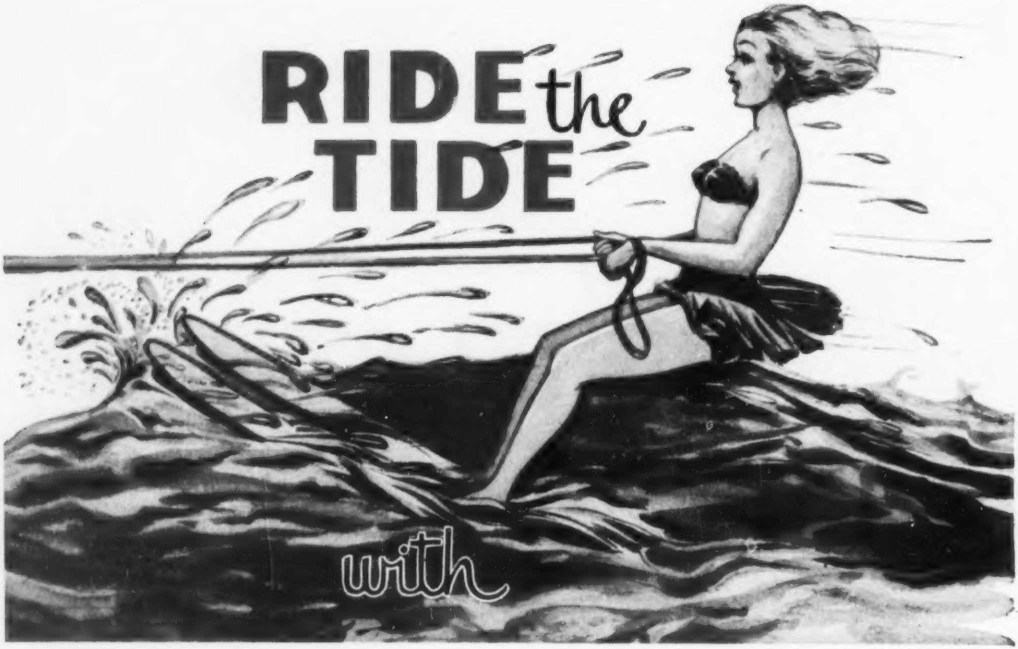

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OUTSTANDING FOR

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Long Range High Temperature Service

For Plasticizers of QUALITY, write

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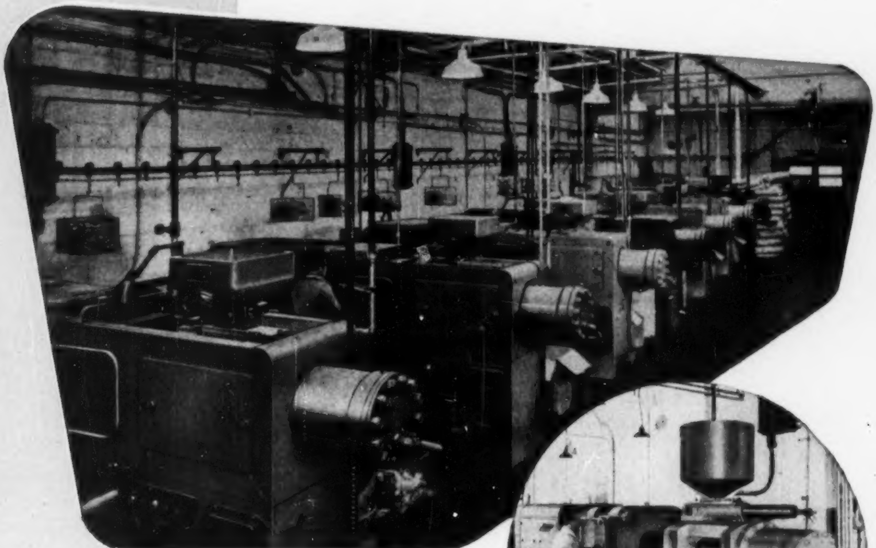
HARDESTY CHEMICAL COMPANY, INC.

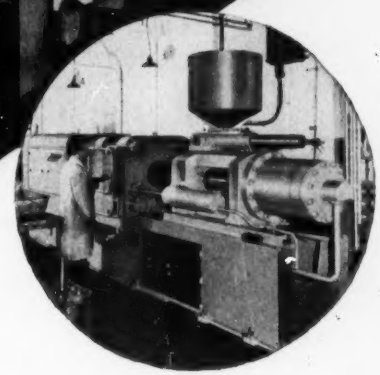
THE KEY TO HARCHEM® BETTER PLASTICS

Manufacturers of Sebacic Acid

Canadian Distributor: W. C. Hardesty Co. of Canada Ltd., 975 Lakeshore Road, New Toronto, Canada

And Why is It Happening?





Why is it that PECO Injection Moulding Machines are continually being installed in one great factory after another? For this plain reason — they turn out the goods, precisely and perfectly, in an unbroken flow. Here, as one notable example, is a view of a massive battery of PECO 8 oz. and 16 oz. machines at International Model Aircraft's establishment at Tri-Ang Works.

MOULDS

PECO MOULDS. Expert designers and mould makers are employed and moulds can be supplied to samples submitted, including die-sinking models if required. An important side of the Company's work is the hobbing of cavities for moulds and medallions—the plant includes a 3,000 ton hobbing plant. Master hobs to customers' samples made as required.

PECO Injection Moulding Machines are supplied in 2, 4, 8 and 16 oz. capacities. They are self-contained with automatic cycle and are hydraulically operated. They have a high plasticising capacity and rate of injection. Mould-locking pressure and platen area enable them to operate at a high rate of production.

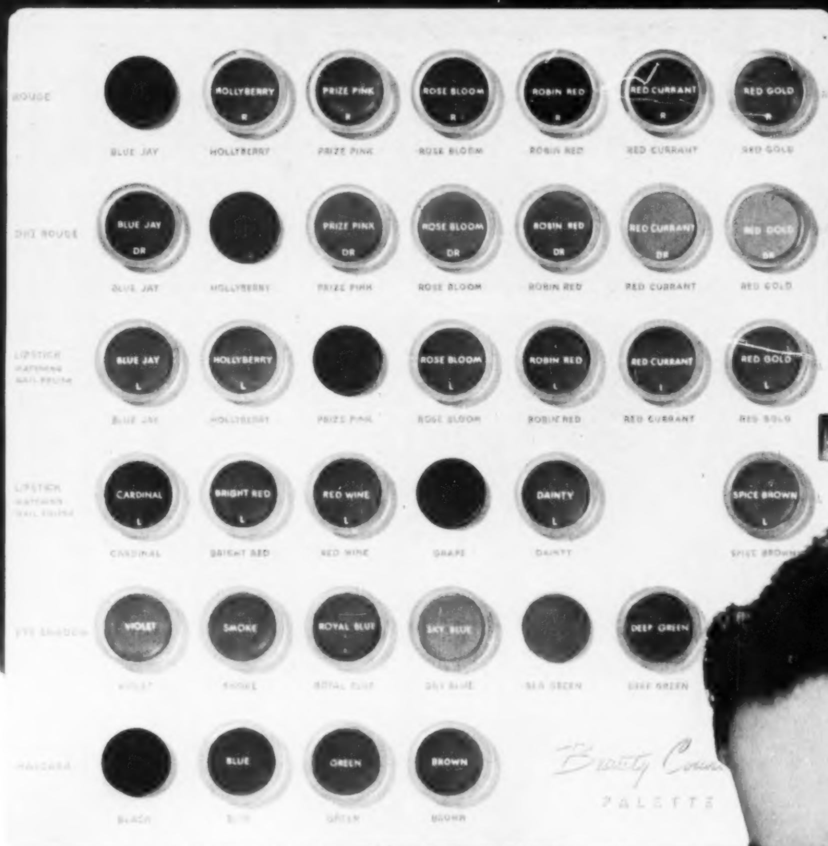
Full particulars of the PECO range of Injection Moulding Machines and Moulds will be sent on request.

PECO PRODUCTS

The PROJECTILE & ENGINEERING COMPANY LTD.

ACRE STREET, BATTERSEA, LONDON, S.W.8

Telephone: Macaulay 1212. Telegrams: "Profectus, Claproad, London". Cables: Profectus, London



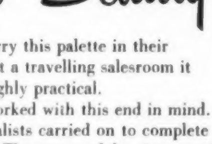
Palette and caps, molded for Beauty Counselors, Detroit, Michigan

Plastics Paths to Beauty

Beauty Counselor cosmetics saleswomen carry this palette in their direct-to-consumer work. Since it is in effect a travelling salesroom it had to be glamorous, impressive yet thoroughly practical.

Raymond Loewy Associates, designers, worked with this end in mind. Elmer E. Mills engineers and molding specialists carried on to complete this product, beautiful to see and easy to use. The nature of the piece required unusually close tolerances on the holes for close friction fit and to allow cam action. Close tolerances were also important so that the individual cosmetics containers go in easily and stay in, yet can be easily replaced when empty. The lettering on the palette was molded. Each of its 37 caps had lettering hot stamped.

This palette is one of numerous pieces which we have made to be used in sales work. It is also one of the many times when we have worked with a client's designer rather than doing the actual design. Call on us either way for molding that is skillful, sound and salesworthy.



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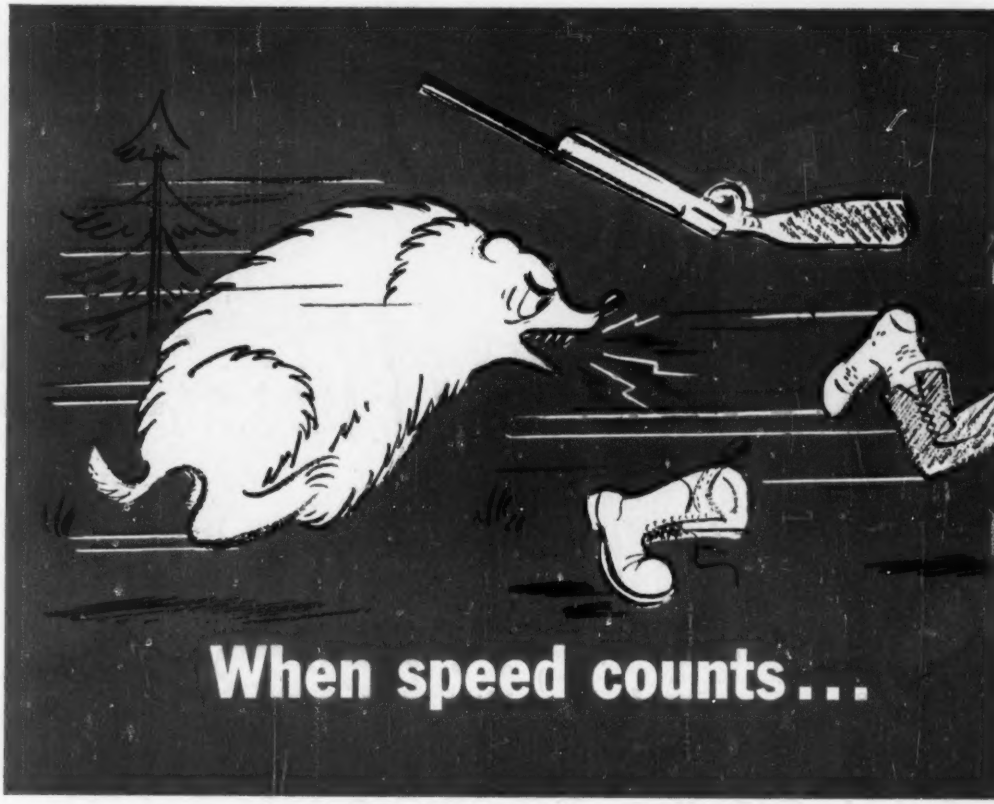
INJECTION MOLDED and EXTRUDED Thermo-Plastic Materials
Including Cellulose Acetate, Cellulose Acetate Butyrate, Acrylates, Methacrylates, Styrenes, Vinyls, Vinylidene Chloride, COMAC PLASTIC*

2930 NORTH ASHLAND AVENUE • CHICAGO 13, ILLINOIS

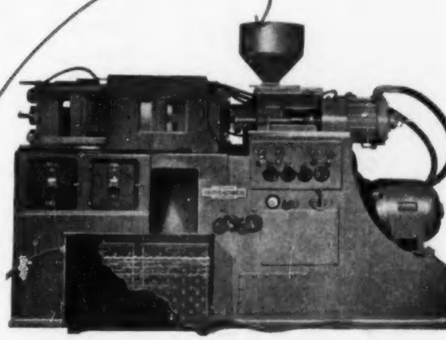
Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about COMAC PLASTIC piping, tubing and fittings, write for circulars containing data and illustrations.*

*Trade Mark Reg.



IN PLASTICS MOLDING speed means money. And now, at last, rapid-fire plastics molding is a reality, thanks to the 10-shots-a-minute cycling of the Fellows 3 oz. machine. With the shots coming so fast that water quenching is often used for product cooling—production capacity goes way UP and costs go way DOWN!

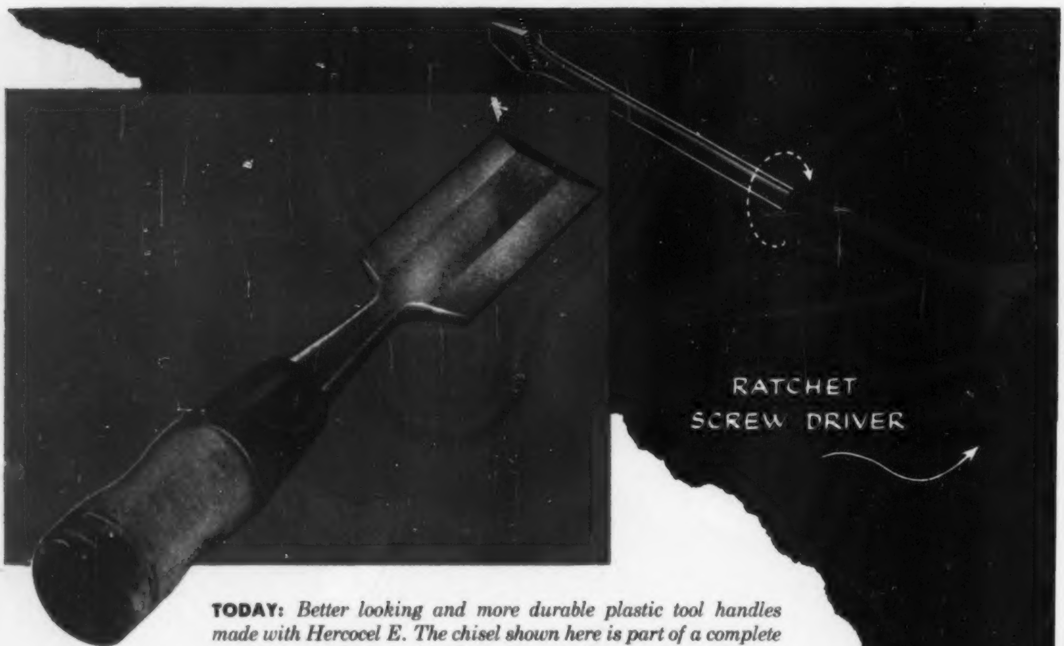
Far ahead in cycling speed, automatic operation, and over-all machine economy, the Fellows 1B-3-15 may mean more money for you! For more information, write, wire or phone today!



Fellows

injection molding equipment

THE FELLOWS GEAR SHAPER CO., Plastics Machine Div., Head Office & Export Dept., Springfield, Vt. Branch Offices: 323 Fisher Bldg., Detroit 2 • 5835 West North Avenue, Chicago 39 • 2206 Empire State Bldg., New York 1 • New England Distributor: Leominster Tool Co., Leominster, Mass.



TODAY: *Better looking and more durable plastic tool handles made with Hercocel E. The chisel shown here is part of a complete line of Stanley Tools, including screw drivers, chisels, and soft-face hammers . . . all made with this rugged, impact-resistant plastic . . . quality products designed for a long and satisfactory service life.*

DESIGNED TO SELL WITH HERCOCEL®

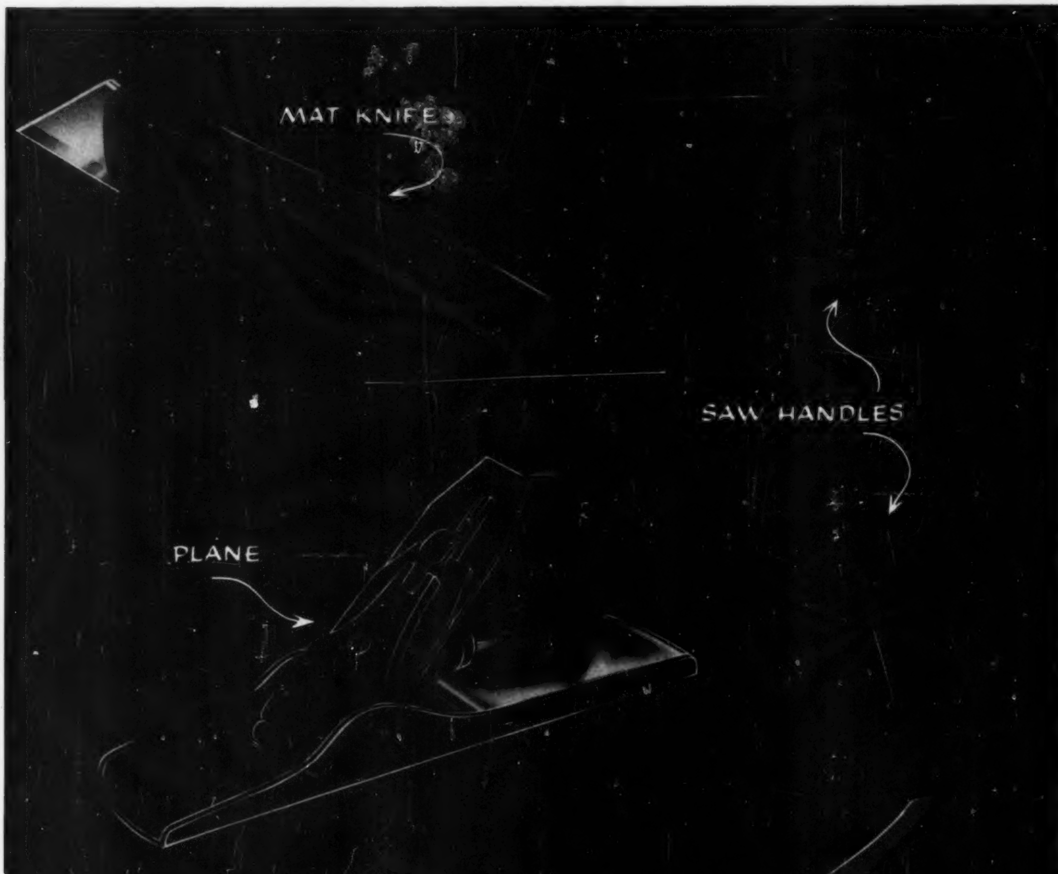
TOMORROW: Greater durability plus increased sales appeal in hardware of many types, thanks to colorful, long-wearing parts molded and fabricated with Hercocel.

Our designer suggests here, in sketch form, a number of new ways in which the versatile Hercocels can be used for handles and housings for tools. All are well suited for speedy, economical mass production. Use Hercocel A (Cellulose Acetate) for toughness and durability at low cost, Hercocel E (Ethyl Cellulose) for parts which must withstand severe exposures and require the exceptional combination of properties no other plastic can provide.

If you make tools, or any other type of "working" product, it will pay you to consider hard-working Hercocel when you plan new products or changes in your present line.

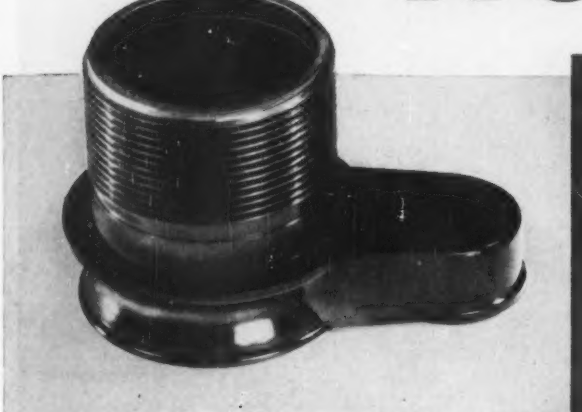
With Hercocel go all the Hercules services, including design assistance, technical counsel, and the facilities of our laboratories. We invite your inquiries.

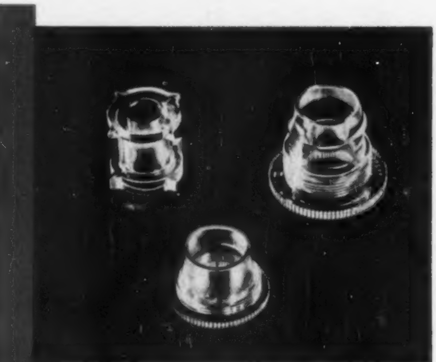
HERCULES POWDER COMPANY
INCORPORATED
Cellulose Products Department, 916 Market Street, Wilmington 99, Delaware


MAT KNIFE
SAW HANDLES
PLANE
STEEL RULER
ADJUSTABLE WRENCH
HERCULES
CELLULOSIC PLASTICS

GP52-7

CUSTOMERS have reason to choose NORTON





Customer:

Indiana Brass Company
Frankfort, Indiana

IN ANY INSTANCE of the use of plastics which calls for fine internal and external threads, you can be certain the customer will be *extra* particular and the molder will have to be *extra* careful. In the case of these valve silencer parts for a toilet flush valve which Norton is molding for Indiana Brass Co. (three of the four are threaded), tolerances are all-important; successful operation of the device hinges on close fits.

Norton has been molding these parts ever since 1943. Several times a year, we are asked to supply new quantities, and the customer has come to know that each batch they receive will be as perfect as the last.

Norton knows that close tolerance molding yields satisfied customers and repeat orders. That is why we have always put the emphasis on flawless molding. When this is coupled with Norton's sensible pricing, on-time deliveries, sound engineering and cooperative service, you can see why many users of custom compression and injection molding have been converted to steady Norton customers.

Norton is interested in cultivating your molding business, too. Ask for a free survey of your next molding assignment by a Norton engineer from our nearest sales office. Norton Laboratories, Inc., Lockport, New York. Sales Offices: *New York—175 Fifth Avenue; Chicago—5221 Kimbark Avenue.*

NORTON *Laboratories, Inc.*

COMPRESSION AND INJECTION MOLDING

Koppers Modified Polystyrene MC 401

cuts shipping and replacement costs

● Koppers new Modified Polystyrene MC 401 combines the toughness and shock resistance of "high impact" polystyrenes with desirable characteristics of regular polystyrene. This combination of qualities is not only making better products available to the public; *it is also paying handsome dividends to molders and manufacturers,* in the form of fewer rejects and reduced shipping and replacement costs.

Mfr.: Standfast Products Company, Cleveland, Ohio; Molder: Sun Plastics, Cleveland, Ohio.

THE SHREDAID, above, features Koppers MC 401 in its handle and lid. It provides smooth, easily cleanable surface as well as the necessary resistance to pressure and impact . . . all important points for customer appeal. The manufacturer mentions additional, money-saving advantages due to the shock resistance of Modified Polystyrene MC 401:

"Since we have used the new MC 401, we have reduced the cost of our shipping cartons about 18% . . . and we can say that the cost of replacements due to breakage in transit, which formerly cut heavily into our profits, has gone down by a very substantial percentage."

Perhaps the characteristics of Koppers Modified Polystyrene MC 401 may be exactly what you need for your present or future products. It is available in a complete range of standard or special opaque colors. Its shock resistance, toughness and attractive finish suggest this Modified Polystyrene for toys, refrigerator parts, household appliances and housewares as well as for battery cases and a wide variety of packaging applications.

Write for Free Bulletin C-2-161-T

which details molding characteristics, physical and chemical properties and other information about Koppers Modified Polystyrene MC 401. This bulletin also contains technical information about Koppers high impact Modified Polystyrenes MC 185 and MC 301. You can call on Koppers for technical assistance in developing new product applications for all Koppers Plastics. Phone, write or wire, and a Koppers representative will gladly call to discuss your problem.

Koppers Plastics make Many Products Better and Many Better Products Possible

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KOPPERS COMPANY, INC., Chemical Division, Dept. MP-9, PITTSBURGH 19, PA.

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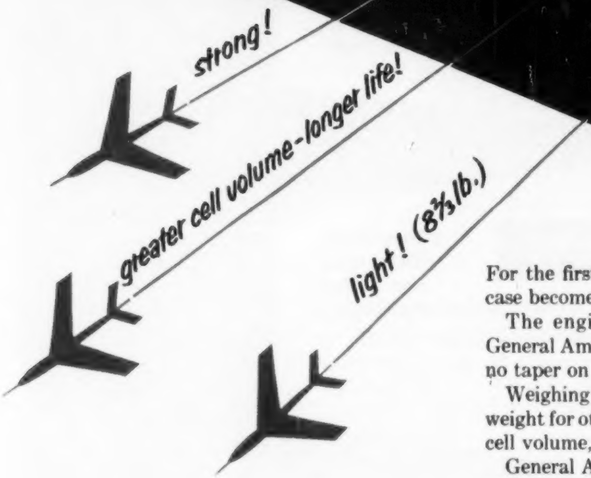
uniformity
FRANCIS SHAW

First again!

One-piece, injection-molded Battery Case by GENERAL AMERICAN



For the first time, a one-piece, injection-molded battery case becomes standard equipment for jet planes.

The engineering and unusual mold design enable General American to produce this one-piece molding with no taper on the outside and minimum taper on the inside.

Weighing 8⅔ lb. (compared with more than twice that weight for other materials) this jet battery case has greater cell volume, longer life and higher electrical ratings.

General American's Plastics Division is one of the most modern and versatile molding sources in the industry with injection presses ranging up to 300 oz. and compression presses up to 2000 tons. A complete source, from development to delivery... *with facilities unduplicated anywhere!* Why don't you find out about them right now? Write for our new brochure.

General American has had more than 50 years of successful experience in manufacturing for America's largest companies.

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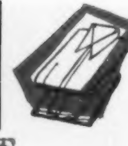
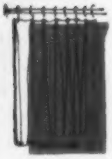
plastics division

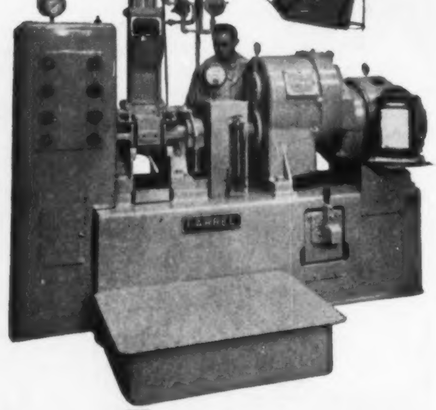
GENERAL AMERICAN TRANSPORTATION CORPORATION

135 S. La Salle St., Chicago 90, Illinois • New York 17: 10 E. 49th St. • Detroit 2: 2842 W. Grand Blvd.



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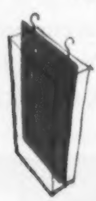
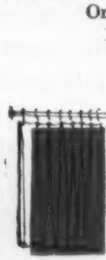
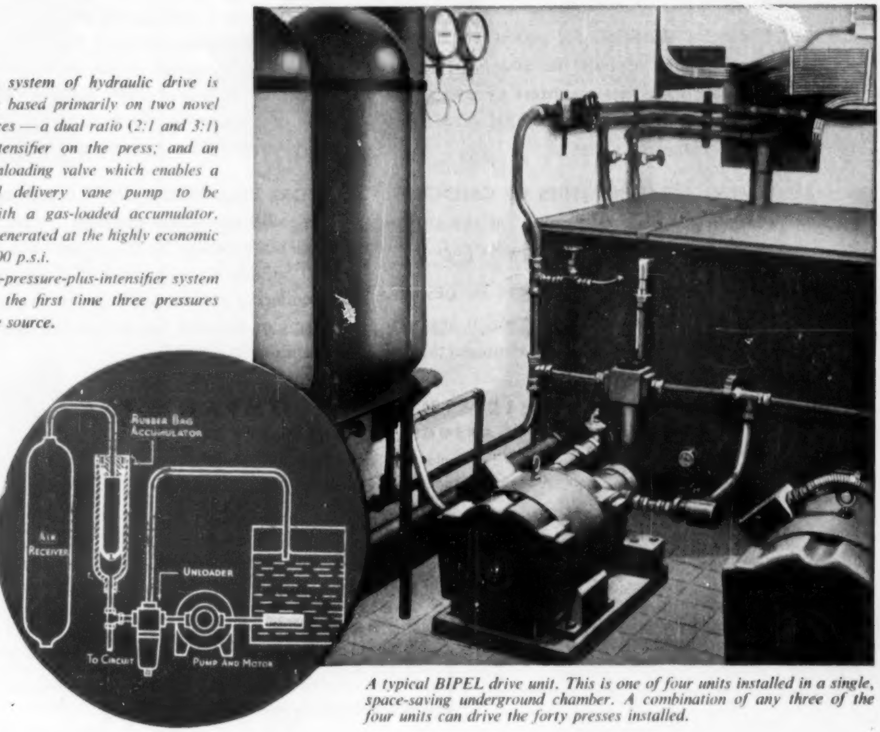




Dollar-Saving Drive

FOR WORLD'S BEST AUTO-CONTROL PRESSES

The BIPEL system of hydraulic drive is unique. It is based primarily on two novel BIPEL devices — a dual ratio (2:1 and 3:1) hydraulic intensifier on the press; and an automatic unloading valve which enables a simple fixed delivery vane pump to be combined with a gas-loaded accumulator. Pressure is generated at the highly economic figure of 1,000 p.s.i.
This medium-pressure-plus-intensifier system provides for the first time three pressures from a single source.



A typical BIPEL drive unit. This is one of four units installed in a single, space-saving underground chamber. A combination of any three of the four units can drive the forty presses installed.

The BIPEL drive system offers a combination of advantages that no other system can offer. It provides a compact, reliable source of hydraulic motive power, cheaper than any other to buy and operate. And, for the first time, it enables a down-stroking prefiller press to provide, from a single supply source, a choice of three molding pressures at will — the initial line pressure followed by intensified pressures of two or three times that figure.

The maximum advantage is derived when the equipment is installed as a group drive feeding a number of presses, up to ten or twelve. Or, as a built-in unit operating a single press, it has many advantages over conventional high-pressure pumps; it still remains simpler and cheaper, requiring less installed H.P. to drive and retaining the feature of three operative pressures.

The BIPEL system, whilst also applicable to manually operated presses, is primarily designed for auto-control which enables the press to reproduce automatically with unvarying precision, any conceivable molding cycle including dwelling and breathing.

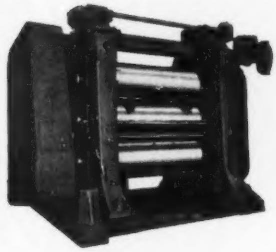
BIPEL presses are made in three models, each affording three molding pressures.

TYPE 40: 20, 40, 60 TONS
TYPE 100: 50, 100, 150 TONS
TYPE 200: 100, 200, 300 TONS

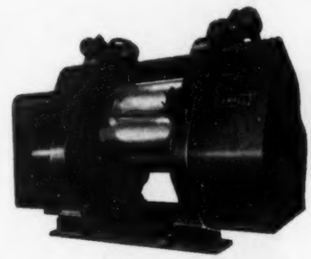
B·I·P GROUP

B.I.P. ENGINEERING LTD., ALDRIDGE ROAD, STREETLY, STAFFS., ENGLAND

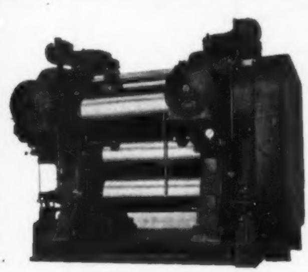
"CALENDER HEADQUARTERS"



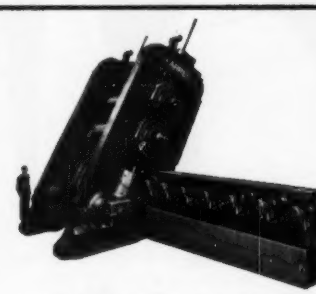
24"x68" three-roll rubber calender equipped with spreader roll, tension roll, knife bar, weighted pressure roll and guides. Windup and letoff are on the other side.



24"x56" special, three-roll, triangular calender for sheeting and coating. Arrangement of rolls facilitates feeding and provides closer control of gauge.



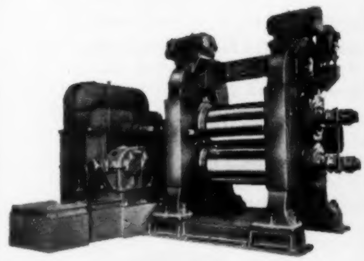
24"x66" four-roll inverted L-type plastics calender with individual motor adjustment on each screw of top and bottom rolls and hand ratchet adjustment for the side roll.



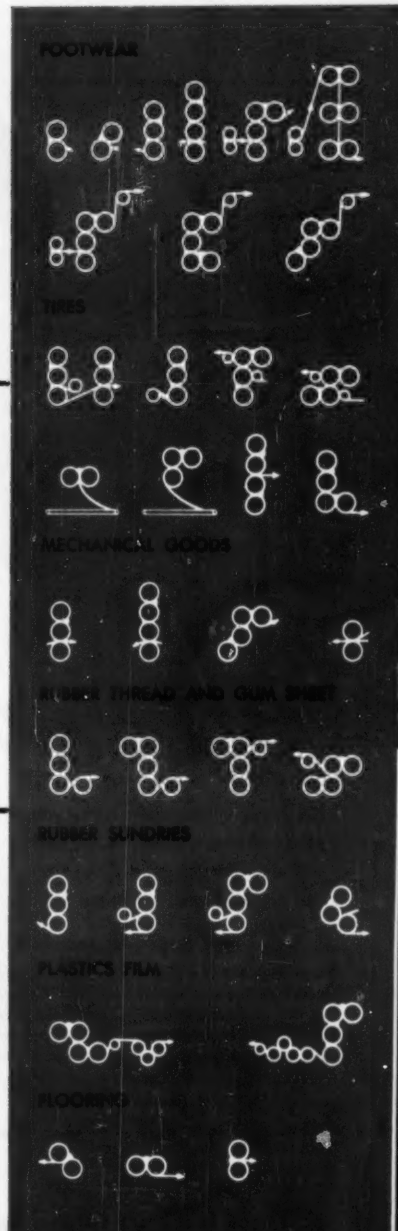
This giant 48"x84" two-roll inclined linoleum calender is the largest in the industry. Because of the great weight of the rolls, a roller table mounted on antifriction bearings is provided for roll removal.

ROLL ADJUSTMENT by individual motor for each screw permits extremely fine adjustment. Pushbutton control provides for adjustment of either roll end separately or both together.

32"x92" four-roll, Z-type calender, specially developed for high-speed, high-precision production of plastic film and for fabric coating.



30"x54" two-roll asphalt tile calender proportioned for great strength and resistance to deflection. Gearing is enclosed in a separate uni-drive.



Farrel-Birmingham®

MODERN PLASTICS

VOLUME 30 SEPTEMBER 1952 NUMBER 1

Test cup molded of silicone-glass compound held molten lead at a temperature of 620° F. for several days without being affected
Courtesy Dow-Corning Corp.

What Silicones Can Do

Courtesy Irvington Varnish & Insulator Co.

Insulating coils of wire by wrapping with layers of silicone-glass tape

FROM an eye-glass wiper to an airplane wing de-icer, from a bake pan coating to a jet engine gasket, from a bovine belch cure; a liquid in a bubble level for a sextant; a vibration damper in an automobile, to insulation for the giant armature coils on big diesel-electric drives for ocean freighters, is only a tiny part of the silicone success story. And these materials have not yet even started their industrial teen-age era.

A rough guess as to the amount of all types of silicones produced in 1951 places production in the neighborhood of 10 million pounds. These various types are divided as follows:

Laminating and molding resins
Coating and varnish resins
Fluids
Silicone elastomers

It is estimated that fluid types presently account for the largest tonnage volume with rubber fairly close behind but possibly the leader soon.

The growth of the silicone industry has been featured by an ever increasing number of applications where silicones are the most satisfactory material ever found for certain jobs. And there are scores of coming big applications where silicones are still in a trial stage.

100 Patents a Year

The ever-widening range of silicone usefulness is indicated by the 400 U.S. patents issued in the silicone field up to 1950. Up until 1940, there were less than 10; but about 100 were issued in each of the years 1949 and 1950, and it is expected that the number will increase each year as more people learn more about the variety of performances that can be expected from silicones.

An unusual angle of the multiple uses of silicones is that many applications require only a tiny amount of silicone per unit. Polishing wax preparations, for example, require only 2 to 4% of a silicone material and the vibration damper for automobiles functions with silicone fluid film only 10 to 20 mils thick.

Family Characteristics

Silicones, which are chemically related to such inorganic materials as quartz, are products of a new branch of chemistry. They are a combination of organic and inorganic substances, and derive their unusual properties both from the strength of the silica molecule and the flexibility of the one or more attached hydrocarbons.

The inherent properties of silicones include unusually high moisture resistance; resistance to cold and heat; non-sticking or release qualities; production or possession of useful surface characteristics; chemical inertness; and oxidation resistance that enables them to withstand long exposure to sunlight, moisture, weathering, and ozone. Their life span is at least 10 times that of comparable organic materials. Silicone rubber is not vulcan-

Courtesy Chemical Div., General Electric Co.

In case of fire, silicone insulation on electrical cable illustrated above burns to non-conducting silicon dioxide, thus permitting service to continue until such time as permanent repairs can be made

Courtesy Chemical Div., General Electric Co.

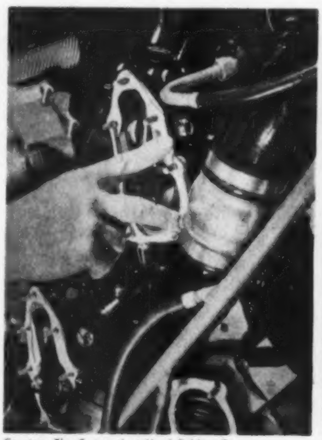
Early use of silicone rubber was in searchlight gaskets, now also made for under-water units

ized by the usual rubber chemicals; it contains nothing after curing which would attack common metals. The same property is common to all silicone materials.

The dielectrical properties of silicone are outstanding. A given thickness of the material will hold back a greater electrical force or voltage over a wider range of temperature and humidity than conventional insulation materials. Other electrical properties such as insulation resistance, power factor, and the many other specialized properties important to electrical applications, are outstandingly good over a wide range of conditions.

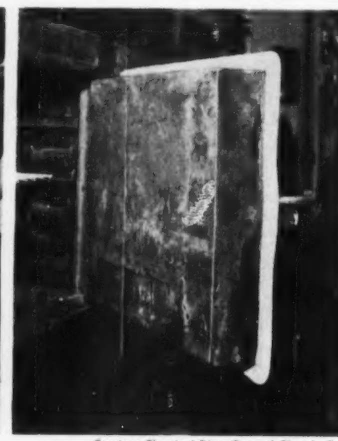
Perhaps the most sought-for property is resistance to both heat and cold. Silicone bonded laminates will give a continuous day-to-day service at 400 to 500° F., and will withstand short time exposure to temperatures up to 1000° F. Silicone aluminum paint for stacks, heaters, and other high temperature equipment will withstand 1000° F. and will last three to five years on stacks that might otherwise have to be painted twice a year. Silicone rubber will withstand a constant temperature of 300 to 350° F. and intermittent temperatures up to 500°. Those limits can be raised by 50° with experimental materials or special construction. The rubber will remain flexible at temperatures as low as —110° F. Two years ago the limit was —70° F.

Another important feature is that silicone polymers may be altered to include any one of a number of organic radicals; today's commercial products are nearly all of the methyl



Courtesy The Connecticut Hard Rubber Co.

Silicone rubber gasket being laid in place on rocker box of Pratt & Whitney aircraft engine



Courtesy Chemical Div., General Electric Co.

Baking oven gaskets of silicone rubber withstand continuous use at temperature of 325°F.

or phenyl composition, and even in this limited category there exists wide differences in high temperature life, low temperature flexibility, curing rates, and toughness. Variations in processing and compounding, together with this ability to polymerize with a host of materials, assures a family of silicones that may have as much or more variety than any group of materials known. Furthermore, it is possible that one of the biggest volume uses for silicone resins may eventually come from their use with other plastic resins to impart greater temperature resistance, better aging, non-sticking qualities, and other inherent properties of silicones.

"Hatred" for Water

Among the first uses for silicone was an electrical insulating material used as a moisture-proof seal for aircraft ignition systems. It is still specified for aircraft ignition and electrical control systems and to seal the junctions in radio and radar equipment.

Silicones "hate" water, yet they allow breathing of the surface they cover while repelling the water. Only a water repellent treatment can keep rain from soaking through the walls of masonry buildings and still let the wall "breathe." A silicone coating for masonry walls is another of the older silicone products, and is expected to become one of the largest. It is asserted that a 2% solution in resin or chemical form will give masonry walls water repellency in a greater degree than any material now known. Silicone resins are also blended with alkyd resins to produce mar-resistant paints and non-yellowing enamels that are weather resistant and serviceable at temperatures in the range of 500° F.

Bakeries are rapidly adopting silicone resin as a substitute for grease in bread pans. It is generally applied with a spray gun, air dried for an

hour and then put in a bread oven to cure at 450° F. for 2 hours. About $\frac{4}{10}$ of a gram is required on a bread pan which will then take at least 200 bakings. In the long run the silicone is cheaper than grease. There is no smoke, as there is from burning grease, which required bakers to paint their kitchens two or three times a month. When baking high sugar content items, a little grease is still required. At the other temperature extreme, one application keeps corn and other frozen foods from sticking to the trays even after freezing for three hours at −20° F. Silicone resin for pan coatings is not for sale to housewives because of the necessity for using flammable solvents in the coating process.

Class H Insulation

The tie-up between silicone resins and the electrical industry is perhaps the most solid, long-time contribution that silicones have made or will make to American life. The principal accomplishment that has followed the development of silicone resins and varnishes has been the introduction of a new class of insulation called Class H, which has made possible a longer life and a 25 to 40% reduction in size of motors and transformers. This reduction in size continues downward as more experience is gained with silicones.

Class H insulation raises the "hottest spot temperature" rating by 55° C. over Class B (formerly the highest grade), or from 257 to 365° F. However, it has been well established that silicone insulation will withstand continuous operating temperatures of 400 to 450° F. Heat resistance is being steadily improved so that a re-definition of Class H insulation temperature may soon be made. Before the advent of silicones, other resins used would carbonize at these high temperatures, and thus become conductors.

Various kinds of tape coated or impregnated with silicones are in use for insulation in Class H equipment. There is a silicone-asbestos tape; a silicone resin-glass fiber tape; and a silicone, glass, and mica tape. A silicone rubber coated glass tape has recently stolen the spotlight. According to Irvington Varnish and Insulator Co. technicians, pioneers in the manufacture of insulation materials, and General Electric Co.'s Chemical Div. officials, the silicone rubber coated tape is easier to produce, easier to handle, and resists mechanical damage in service. The silicone rubber glass tape can be dip, knife, or calender coated, but the silicone resin-glass is generally dip coated only.

It has been proved that silicone insulation will have 10 times longer life than Class B insulation, even when operated at the high temperature limits of Class H. Ten horsepower motors equipped with this insulation have been built that are no larger than ¼ horse motors equipped with traditional insulation, because they can run hotter without damage.

The corona (incipient arcing) resistance of silicone rubber coated tape is equal to that of mica, and it will remain flexible at a high temperature of 500° F. or a low of −110° F.; the better grades of silicone resin coated tape lose some of their properties at −40° F.

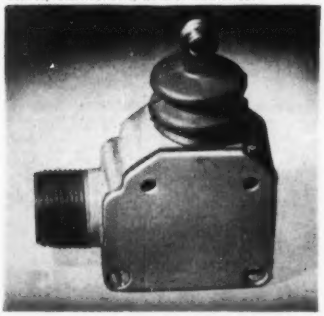
Enamel on the Way

These silicone coated or impregnated materials find their principal use as insulation on wire and in sleeves for wiring systems, motors, transformers, and other electrical equipment. At present the minimum size motor with silicone wrapped wire windings is ½ or ¼ horsepower. Smaller motors generally require enameled wire. Even though silicone enamel for wire is not yet commercially perfected, it is reported that a motor with this type of wire is now giving satisfactory performance.

Silicone tape of one type or another is also a necessary part of insulation used in all types of electrical machinery that must withstand high temperature. Big diesel-

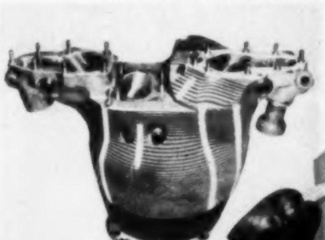
Boots of silicone rubber seal dust and moisture out of aircraft limit switches and remain flexible below −67° F. Big planes carry as many as 100 such switches for various controls

Courtesy Chemical Div., General Electric Co.



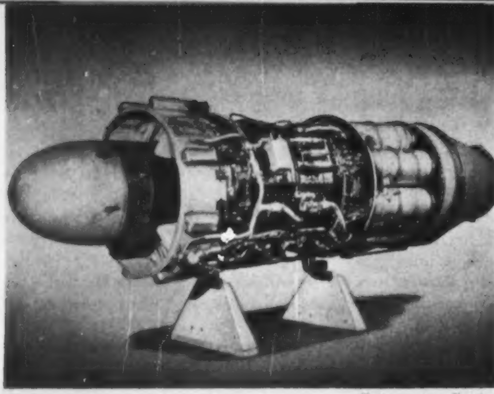
Strips of uncured silicone rubber, pressed in place on the fins of an aircraft engine, cure when engine warms up. The cured strips then reduce vibration and prevent breakage of fins

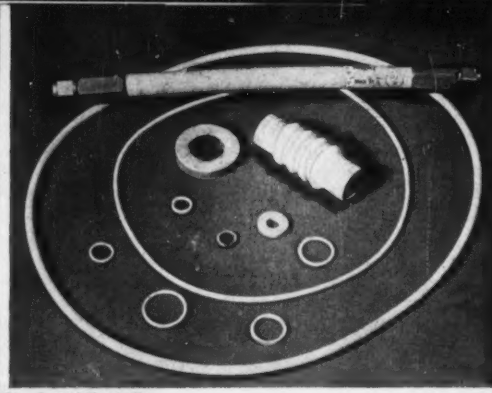
Courtesy The Connecticut Hard Rubber Co.



Low temperature flexibility of silicone rubber is demonstrated by worker in sub-zero testing chamber. Improvements in formulation have reduced the temperature to which the material will remain flexible from −70° F. two years ago to a low of −110° F. today

Courtesy Chemical Div., General Electric Co.





Photos courtesy Chemical Div., General Electric Co.

Because silicone rubber can be formulated to give continuous service at high temperatures, it is being widely adapted for use in turbojet engines such as the one at the left above. In the photograph at the right is a representative selection of the silicone parts

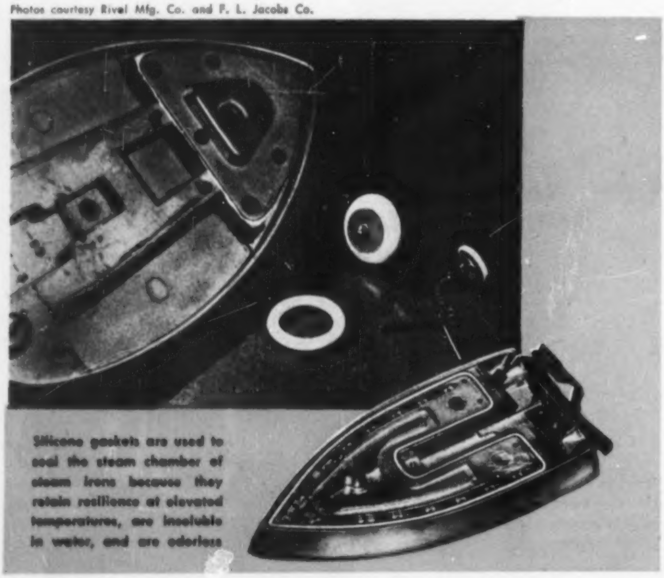
electric units for ships and locomotives, huge motors for Banbury mixers, are among those now using silicone tape wrapped stator coils. The wrappings are sometimes as much as ½ in. thick. The traditional materials for this purpose have been mica and various types of resin or asphalt impregnated paper. The silicone-glass tape has the additional advantage that it can be stored whereas the asphalt materials dry out.

The U. S. Navy is particularly interested in silicone-glass insulation materials of all sorts, but especially for wire. New specifications for Navy power cable call for two layers of silicone rubber covered glass tape plus four layers of silicone resin glass tape. The rubber is for cushioning and improved thermal conductivity, and the resin-glass for additional dielectric strength.

Another use for silicones of various types in Navy wire is for sealing. Various types of silicone rubber and silicone paste or mastic are used for sealing out both air and water. For example, National Engineering Products, Washington, D.C., has developed a modified silicone mastic for use between conductors in a cable to seal against water infiltration. Some of the previously used plastics materials developed excessive pressure at 145° C. which led to fracturing of the cable jacket. Silicone mastics minimize that danger because of their heat stability.

The types and uses for silicone insulated wire are varied and complex. New ideas and developments crop up constantly in this highly technical field. Such products as a comparatively new airplane conductor wire insulation made from silicone impregnated felted asbestos covered with glass braid, and the whole impregnated with silicone resin, are likely to be coming off production lines in a continuing parade. It should also be noted that the same materials from which tapes are made can be fabricated into hot air ducts, where they are especially valuable because of both heat and cold resistance.

Photos courtesy Rivel Mfg. Co. and F. L. Jacobs Co.



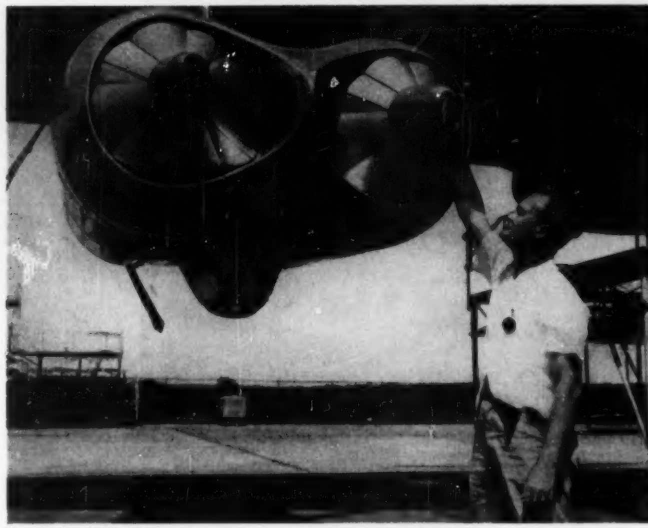
Silicone gaskets are used to seal the steam chamber of steam irons because they retain resilience at elevated temperatures, are insoluble in water, and are odorless

Laminates

Silicone fibrous glass laminates and a limited number of molded parts are of course a vital part of Class H insulated electrical machinery, although they have had a tough time during their introductory years. [See also "Silicone Resin Bonded Laminates," by L. V. Larsen, J. J. Whelton, and J. J. Pyle, MODERN PLASTICS *23*, 160 (March 1946).] Only Dow-Corning of the two major producers of silicones makes a laminating and molding resin, and are frank to confess that they are still working diligently to improve its properties. General Electric expects to in-

Courtesy Dow Corning Corp.

The young lady's sharkskin suit is treated with a silicone water repellent which withstands dry-cleaning. Water droplets brush off, leaving cloth dry



Courtesy Dow Corning Corp.

Various types of heating elements can be embedded in silicone rubber. Here a unit is being put in place to prevent icing of the air intake doors on a jet aircraft engine

troduce a new high pressure laminating resin within the next year.

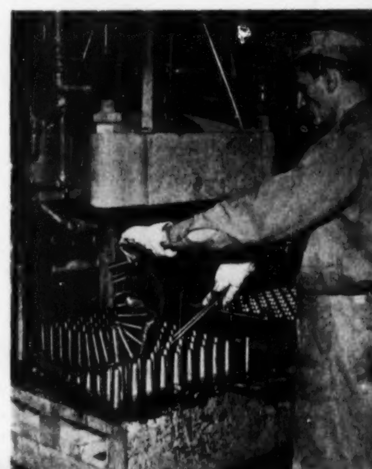
Thousands of pounds of silicone-glass laminate are giving satisfactory use today, but practically everyone concerned is convinced that a stronger resin which requires less time to cure would vastly increase the demand for silicone. Generally speaking, about 24 hours is required to cure high pressure silicone-glass laminates.

It is expected that the recent development of a low pressure silicone resin for laminates ["Silicone-Glass for Low Pressure," MODERN PLASTICS 29, 106 (April 1952)] will perhaps supersede high pressure silicone laminates, and add another step to industry progress. However, even though the laminates may now be formed on much simpler equipment, about 120 hr. are required for curing. The advantage is that laminators will be able to form more complex shapes, and thus make the material more suitable for aircraft parts, radomes, and the like.

The Navy's Bureau of Ships and the U. S. Air Force have been extremely interested in silicone-glass laminates for such things as electrical panel boards, switch breakers, structural parts, slot wedges, etc. Since World War II they have sponsored several million dollar's worth of research contracts with laminators who are now making laminated sheets, to meet required specifications drawn up by both the Armed Forces and by N.E.M.A.

The low loss factor makes these laminates interesting for use in high frequency dielectric equipment. The silicone is used to support heating electrodes. Most of these applications are for military electronic equipment, and no further information is available.

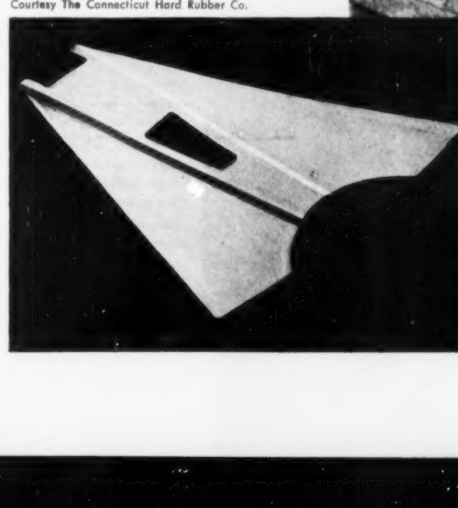
Although it sounds big, the use of silicone resins in glass laminates is perhaps the smallest single use of the four groups named earlier in this article. It has been estimated that not much more than 60,000 lb. were used for this purpose in the last quarter of 1951. One of the limiting factors is price. Silicone laminates sell for $6.50 a lb. or approximately four times the cost of canvas phenolic laminates, or seven times the cost of paper phenolic. The new



Courtesy Dow Corning Corp.

As a mold release agent, silicone can reduce mold cleaning schedules from weekly to as infrequently as every four months

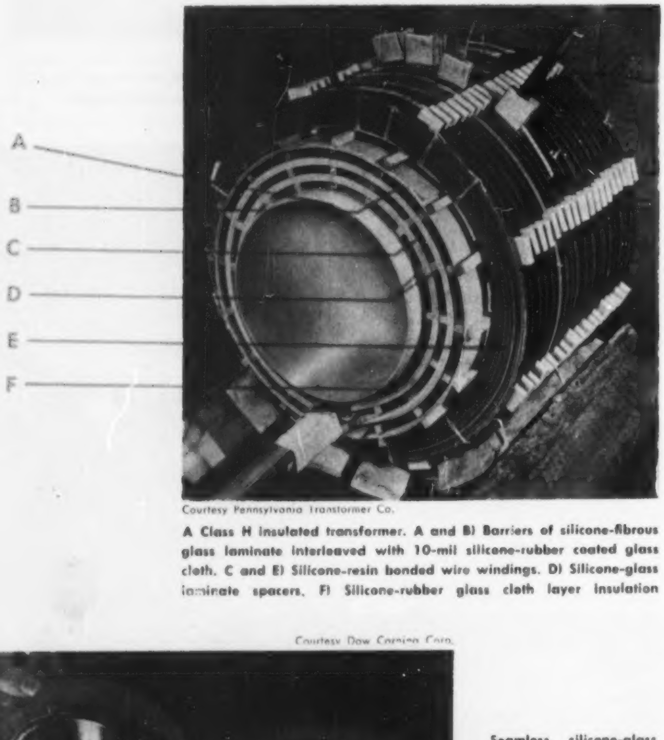
Courtesy The Connecticut Hard Rubber Co.



Heating units (left) with wires embedded in silicone rubber can be made in almost any size and shape including strips that can be cut to length

Courtesy Dow Corning Corp.

Silicone resin coating replaces grease on baking pans, gives easy release for 200 or more bakings. There is no smoke or char; bread crust is baked, not fried



Courtesy Pennsylvania Transformer Co.

A Class H insulated transformer. A and B) Barriers of silicone-fibrous glass laminate interleaved with 10-mil silicone-rubber coated glass cloth. C and E) Silicone-resin bonded wire windings. D) Silicone-glass laminate spacers. F) Silicone-rubber glass cloth layer insulation

Courtesy Dow Corning Corp.

Seamless silicone-glass laminates made with preforms in matched metal molds. Molding temperature is 348° F., pressure only 3 p.s.i. for 15 minutes. Right to left: Preforms, piece as from mold, and trimmed piece

lower cost glass fabrics may reduce this cost somewhat.

Other limiting factors are the low strength of the resin, which in turn makes it difficult to produce laminates which have a satisfactory mechanical strength; silicone resins are attacked by hydrocarbons like benzene and toluene, and cholorinated solvents, such as carbon tetrachloride, and thus can't be used in oil well equipment, even though they have good resistance to most other chemicals.

Notwithstanding these limitations, the silicone laminates have found a firm place in industrial insulation, particularly because of their extreme heat resistance. For example, laminated spacers in a 45,000 ampere bus switch of an electric furnace were still in good condition after 11 months of service, including brief exposures to red-hot temperatures when an electrician forgot to tighten the hinge pins.

Molding Material

Silicone molding material has been in limited use up to the present time. A few parts have been produced for electrical equipment. A weak resin, length of time required to cure, and lack of uniformity are the primary hold-backs. A small circuit breaker base, about 4 in. sq., without parts, would cost around $75, but it will take an operating heat of 400° F. If the load is not too heavy, it will resist 550° F. One advantage in molding silicone is that it doesn't stick to the mold.

Silicone moldings require as much as 1 hr. in the mold and 21 hr. of after-baking at temperatures up to 250° F. The molding compounds are generally about 50% resin; 10 to 15% diatomaceous earth, and 35% inorganic filler such as chopped fibrous glass or asbestos. Glass has proved most acceptable to date. Asbestos makes good-looking moldings but is seldom iron free, and thus degrades the electrical properties.

It is quite probable that producers will some day find a better catalyst and develop a good, new resin for molding purposes. The present resin is too "dead" or inactive, and if the catalyst is stepped up to save time, the material loses its good properties. Management has been so busy with silicone rubber, greases, and waterproofing materi-

als, that they have not yet had time to really go to work on their laminating and molding resins. But new developments are in the offing. It is highly significant that despite the admitted lack of perfection, present applications are in many cases giving better service than can be had from any other known material at this time.

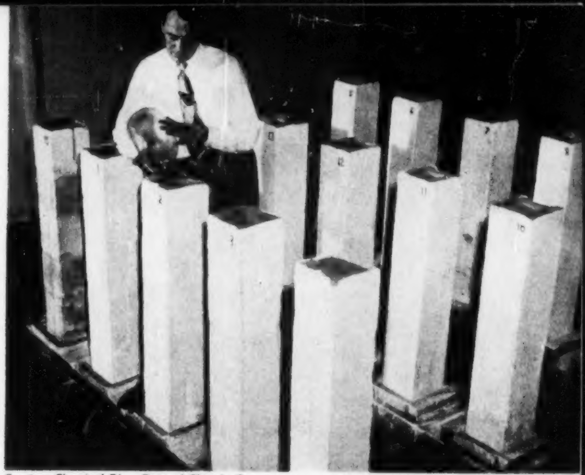
Electrical Transformers

The use of silicones in motors to help make small ones do the work of big ones is an accepted and well publicized fact. But just as important, and of later vintage, is the part that silicone glass tape and laminates are taking in the development of a new type transformer that has the electrical industry all agog. Melvin L. Manning, Development Engineer of the Pennsylvania Transformer Div., McGraw Electric Co., Canonsburg, Pa., is considered one of the country's outstanding authorities on silicones and Class H insulation. Says Mr. Manning:

"There is little doubt that Class B insulation will be replaced eventually by Class H insulation in dry type transformers. Why impregnate glass fiber and asbestos base materials which will withstand temperatures of melting metals with combustible synthetic varnishes as we have done in the past, when silicones are available? . . . Volume production of Class H insulation will force present costs downward. For example, Class B and Class H insulated wires are now on the same price level. This is the first silicone insulated item in volume production. . . . Install Class H transformers where you believe the worst conditions exist, such as overloads, high ambient temperatures, contamination, and where you desire absolute safety.

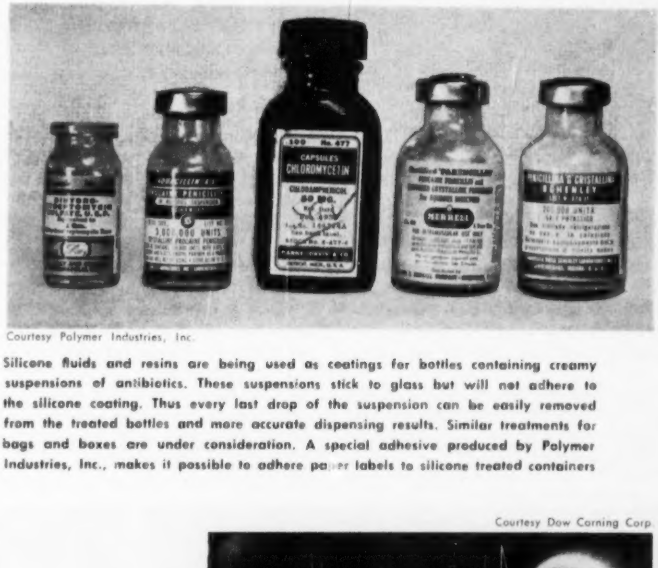
"Investigations show that approximately 70 years' life can be expected for Class H insulation at 356° F. hottest spot temperature, as compared with 7 years' life for Class B insulation at 266° F. At 392° F., the life of Class H is about 1000 times the life of Class B—20 years versus one week."

A big advantage for Class H transformers of ventilated construction is that they are smaller and require 15% less copper and steel than the conventional Class B dry type transformers. Nitrogen sealed trans-



Courtesy Chemical Div., General Electric Co.

Test piers used to determine effectiveness of silicones in waterproofing masonry. Control pier at extreme left was given two coats of cement and filled with stained water. Leakage shown occurred in seven hours. Other piers were treated similarly, but with silicone added to the cement

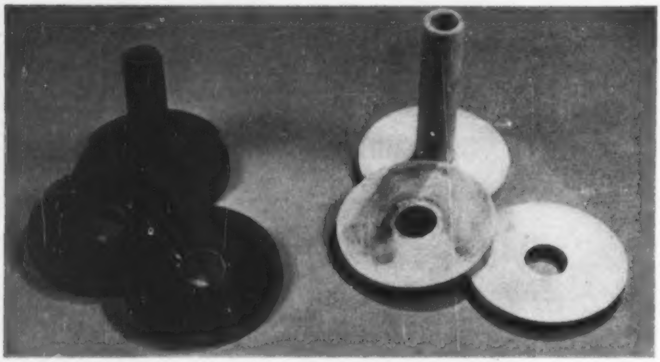


Courtesy Polymer Industries, Inc.

Silicone fluids and resins are being used as coatings for bottles containing creamy suspensions of antibiotics. These suspensions stick to glass but will not adhere to the silicone coating. Thus every last drop of the suspension can be easily removed from the treated bottles and more accurate dispensing results. Similar treatments for bags and boxes are under consideration. A special adhesive produced by Polymer Industries, Inc., makes it possible to adhere paper labels to silicone treated containers

Courtesy Dow Corning Corp.

Torsional vibration damper for automobile engines has a thin film of silicone fluid (arrows) sealed in a housing. Silicone is the only practical fluid for this use because it maintains uniform viscosity regardless of changes in temperature



Courtesy Dow Corning Corp.

Conventional insulators on high-amperage switches (left) cracked in a month, required daily tightening. Silicone-glass insulators give years of service, never need tightening

formers require larger parts and heavier tanks than ventilated types in order to withstand pressures encountered in service, and to allow sufficient surface area to take care of heat dissipation.

Fire insurance companies are raising rates for insurance protection on transformers installed in buildings, and oil-filled transformers are not approved for such indoor applications, except where expensive steel vault enclosures are used. Other liquid-filled transformers, although approved, have other handicaps. Users are often forced to install oil-filled transformers outdoors, necessitating long bus copper runs. But explosion-free dry-type Class H units can be installed indoors without expensive vaults with resultant savings in bus copper runs.

It is now possible to obtain 5000 through 50,000 volt Class H transformers from 500 through 1500 KVA for almost the same price as Class B units.

Silicone Rubber

Closely allied to the silicone varnishes and laminates in their association with the electrical industry is silicone rubber. Its scope of application is broad but its possibilities can be shown by citing a few representative uses.

All types of silicone rubber will withstand continuous exposure to temperatures of at least 300° F. for an indefinite period of time. For many applications, it has given satisfactory service at temperatures above 500° F. But, amazingly enough, these rubbers are also serviceable at −70° F., with some stocks being serviceable at −100° F. This rare serviceability over a 600° F. temperature range makes these rubbers especially applicable for airplane applications in a ship that takes off from a tropical jungle and reaches the sub-zero stratosphere in a few minutes' time. In addition, engineers say that they have nearly all the properties of an ideal dielectric. Not the least of the superb properties is resistance to compression set, which means that the rubber bounces back to its original shape at temperatures from −70° to 500° F., when other materials become either stiff or sticky.

Even though silicone rubber is characterized by an order of stability unique among rubber-like materials, fabrication methods are similar to those used in forming conventional rubbers. The major difference lies in the oven curing at high temperatures which are required to develop optimum properties in the finished part.

Strength Going Up

Silicone rubber is not noted for its strength. It was first called a cheese-like material by some critics. But new techniques for handling and improved compositions now on the way indicate that its strength may

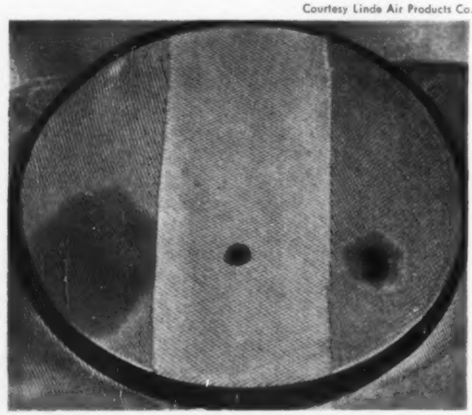
(*Continued on p. 184*)

Oxy-acetylene torch flame (5000° F.) burned through 2-in. steel plate; in same length of time it only melted some of the glass in Class H insulation

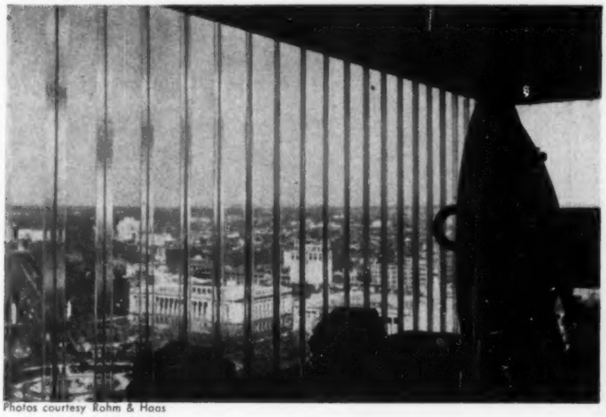
Courtesy Pennsylvania Transformer Co.

Water "hatred" of silicone is shown by placing drops of water on treated and untreated glass cloth. Photo was taken 15 sec. later

Courtesy Linde Air Products Co.

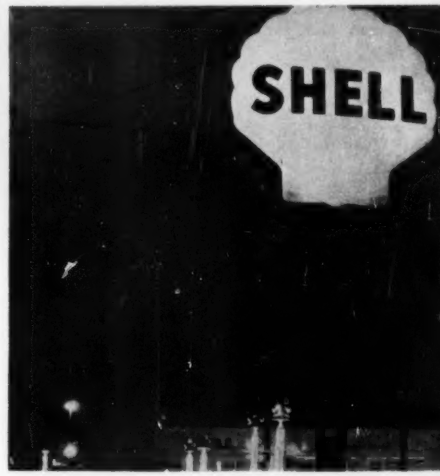


No. 3 of a Series
of Articles on the Economics
of Plastics Sheet Forming—1952



Photos courtesy Rohm & Haas

Six-ft. high transparent acrylic panels, formed into deep V-rib corrugations cemented together at the edges, enclose T. V. relay station



Acrylic sign, illuminated from within, is made up of two formed sheets separated by 9 in. steel filler band; sign is 8 ft. in diameter

ACRYLICS — NEW METHODS NEW MARKETS

FROM the time of their introduction in the late 1930's, the cast acrylic sheet materials had several advantages in forming properties.

First, they have minimum shrinkage upon heating, so accurate die size estimates can easily be made. Second, they can be readily formed by the use of air pressure differentials. Third, the cast acrylics can be direct compression formed or molded. Fourth, tooling costs are low.

During more than a decade of experience by fabricators there has been developed a series of standardized techniques for forming acrylics which were presented in the 1950 "Modern Plastics Encyclopedia and Engineer's Handbook."

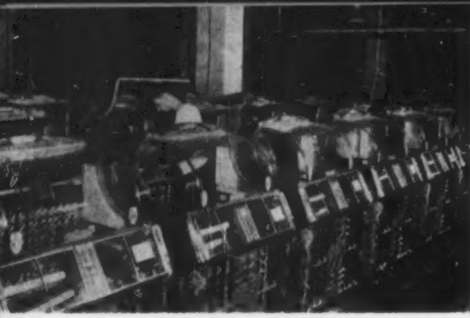
It is small wonder that, following their use in aircraft canopies in World War II, the cast acrylics, having these properties, made such great progress in large-area formed applications. Most of these applications were for short-run jobs; most could stand the cost of the hand labor involved; most in the early days had to be specially designed and engineered.

The large out-door signs, interior lighted, in which the acrylics replaced enameled steel, and the many formed architectural applications, such as domed skylights, are examples. The material has weather resistance, impact resistance, sunlight resistance, light weight, beautiful colorability, and the property of "piping" light.

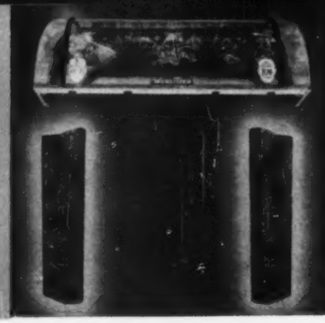
Further Refinements

The main advances in cast acrylic production since 1945—the development of high heat resistant material, the development of fluorescent acrylic, and the development of large sheets up to 8 by 10 ft.—necessitated only further refinements of the standard techniques. Larger ovens were required and ovens capable of producing higher heat; handling methods for the large sheets had to be improved; and better die design had to be worked out for the maintenance of uniform wall thicknesses in various degrees and depths of draw.

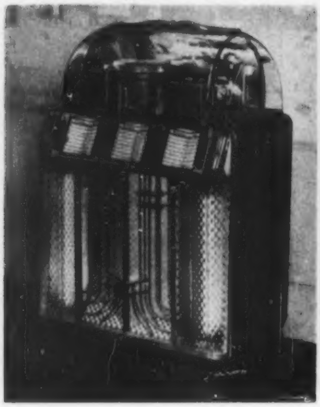
In the aircraft field, where acrylics first found markets, there comes the need for still larger and larger formed parts and for much stronger formed parts. Already acrylic sheets laminated on both sides of polyvinyl butyral to provide increased strength are moving into the aircraft field, particularly for use in high altitude planes. With faster jets com-

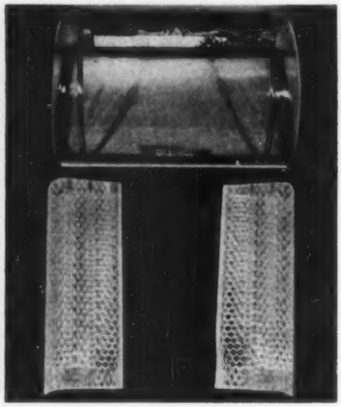


New automatic phonographs (left) contain 20 sq. ft. of vacuum formed acrylic sheet, silk screened flat before forming; acrylic parts include dome, valance, pilasters (right)



Photos this page courtesy Rohm & Haas





Earlier model of phonograph (left) has center of dome (right, top) formed from acrylic sheet, pilasters (right, bottom) and dome end caps are injection molded

ing up, increased skin temperatures and increased pressures are going to create a requirement for new types of formable acrylics.

With the advent of extruded cast acrylic sheet, there has come some change in acrylic forming. Extrusion of acrylic sheet up to at least 3/16 in. is inevitably more economical than casting, and acrylic sheet extrusion is improving very rapidly. But extrusion can produce a product with certain orientation and an inclination to shrink in one or more directions, depending on the method used and on the take-off. This means that the same forming techniques now used for the copolymers, as described in our July article, will have to be used, particularly in the vacuum forming of extruded acrylic sheets for architectural, lighting, and other purposes. Where particular optical effects are required, possible optical distortion by orientation in forming will have to be overcome.

New Markets

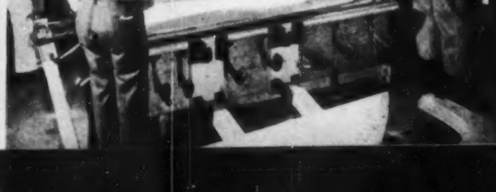
These engineering problems in forming techniques for extruded acrylic sheets are quickly being overcome, and the lower cost material is bound to get new markets in interior signs and displays, in the lighting field, in architecture, in housings for dispensing machines and automatic public phonographs, etc.

Meanwhile, the injection molded acrylics have begun to compete with the smaller size and even some larger size formed sheet applications. When an order for small signs begins to run into the thousands instead of hundreds, and when the cost differential between molding material and casting material is so great, and when optical perfection need not be too extreme, the big new injection presses can do an economical job.

Here again, extrusion may quite easily change the picture, in due course, in favor of vacuum forming. Injection molded flat sheet material with molded-in lenses or prisms for lighting and reflective sign work is well known. Currently, work is be-

Cast acrylic sheet, heated until it is pliable, is removed from an oven rack, to be clamped in place over an air pressure tank

Acrylic is free-blown over tank into a bubble designed for use on nose of helicopters; the surface area of the bubble is 125 sq. ft.



ing done on the possibility of extruding a similar material which will naturally lend itself to forming techniques.

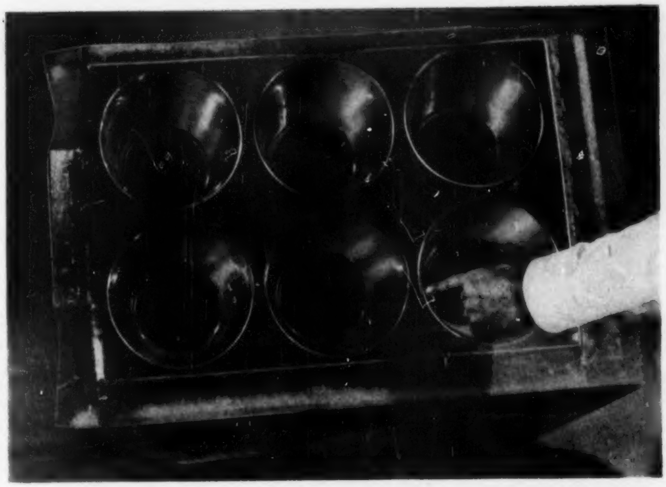
Bi-axial Stretch

Very recently, experimental work has been done on a new method of forming acrylic, known as the "multi-axial stretch" or "bi-axial stretch" forming technique. The idea is based on the fact that oriented cast acrylic may have greater impact strength than straight cast material. Roughly, the method is to take a sheet of cast acrylic, heat it, and stretch it evenly both ways until it is half its original thickness. Then it is placed in a strong holding frame to prevent shrink, is heated again, and formed. According to fabricators who are studying this new method, not only is the impact resistance, tensile elongation, and stress solvent craze resistance of the formed job considerably improved, but larger sized single-piece formed acrylic jobs may be made by this method, since stretching to half the thickness at least doubles the area.

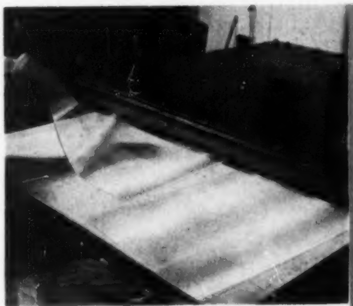
In many cases, there will be combinations of several formed and injection molded pieces in a single application. A case in point is the big new automatic phonograph No. 1500, made by Rudolph Wurtlitzer Co., North Tonawanda, N.Y. There is a lot of acrylic used in each unit. The clear domes consist of a large curved center panel mounted between two end caps which are vacuum formed from sheet Plexiglas. The pilasters are also formed over wooden molds from flat cast sheet material that is silk-screened in a multi-colored motif of musical notes prior to the forming operation. This application of formed acrylic represents a use of approximately 20 sq. ft. of sheet per machine.

Molded or Formed?

All acrylic parts on the Wurlitzer No. 1500 model are currently being formed; but in the company's model No. 1400, still being made in large volume, end caps on the dome and pilasters were injection molded by Erie Resistor Corp., Erie, Pa., because of the volume of parts required and because of diamond-faceted pilasters. The economics of the switch from injection molding to forming or vice versa depend (*Continued on p.* 191)

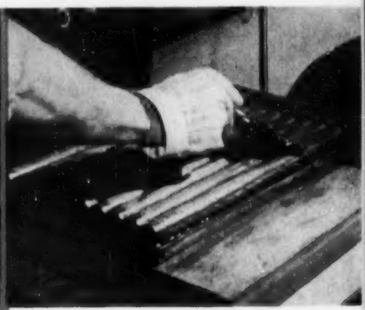


Display bucket is vacuum formed from acrylic sheet in six-cavity die. Pattern heating and use of slip rings prevent thinning out of wall sections at bottom of draw



Photos courtesy Durable Formed Products

In compression forming of corrugated acrylic panels, material is heated till flexible



Wooden male mold is then coated with grease, soft acrylic laid on top

Female mold, also coated with grease, is placed over the male mold; press is then closed

Cycle for forming the acrylic corrugated panels is approximately 15 min.

Table [illegible]—United States Production and Sales of Plasticizers, 1951

Chemical	Production	Sales: Quantity	Sales: Value	Sales: Unit Value
	1000 lb.	1000 lb.	$1000	Per lb.
GRAND TOTAL	280,385	209,822	83,934	$0.40
PLASTICIZERS, CYCLIC				
Total	203,548	151,613	57,379	.38
Phosphoric acid esters:				
Tricresyl phosphate	17,255	16,680	5,905	.35
Triphenyl phosphate	7,240			
Phthalic anhydride esters, total	157,225	114,189	44,093	.39
Dibutyl phthalate	19,004	13,948	5,397	.39
Di-2-ethylhexyl phthalate	64,861	45,345	18,222	.40
Diethyl phthalate	17,938	12,018	3,550	.30
Di-iso-octyl phthalate	8,278	7,526	3,019	.40
Di(2-methoxyethyl) phthalate [Di(methyl cellosolve) phthalate]	1,976			
Dimethyl phthalate	4,362	3,488	844	.24
Di-n-octyl phthalate		12,317	4,996	.41
All other[1]	40,806	19,547	8,065	.41
All other cyclic plasticizers[2]	21,828	20,744	7,381	.36
PLASTICIZERS, ACYCLIC				
Total	76,837	58,209	26,555	.46
Adipic acid esters, total	7,113	4,574	2,158	.47
Di(2-ethylhexyl) adipate	1,082			
Di-iso-octyl adipate	2,455	1,346	622	.46
All other[3]	3,576	3,228	1,536	.48
Lauric acid esters, total	1,107	736	316	.43
Propylene glycol monolaurate	143			
All other[4]	964	736	316	.43
Oleic acid esters, total	6,697	3,793	1,516	.40
Diethylene glycol mono-oleate	500	366	147	.40
Glyceryl mono-oleate	952	563	246	.44
Polyethylene glycol dioleate	31	17	7	.41
Polyethylene glycol mono-oleate	571	251	98	.39
All other[5]	4,643	2,596	1,018	.39
Phosphoric acid esters[6]	9,240	6,802	3,007	.44
Polyethylene glycol ester of coconut oil fatty acid	118			
Ricinoleic acid and acetylricinoleic acid esters[7]	4,707	3,261	1,406	.43
Sebacic acid esters, total	7,133	5,565	4,351	.78
Dibutyl sebacate	2,812			
All other[8]	4,321	5,565	4,351	.78
Stearic acid esters, total	16,951	15,285	5,699	.37
Butyl stearate	1,977	1,517	523	.34
Diethylene glycol monostearate	433	435	149	.34
Glyceryl monostearate	8,411	7,530	2,972	.39
Propylene glycol monostearate	170	163	66	.40
All other[9]	5,960	5,640	1,989	.35
All other acyclic plasticizers, total[10]	23,771	18,193	8,102	.45

[1] Includes data for phthalic anhydride esters of phenols, fatty alcohols, castor oil, mono- and polyhydric alcohols, cellosolves, and phthalyl glycolates.

[2] Includes data for synthetic camphor, coumarone-indene, toluenesulfonamides, phosphoric acid esters, tetrahydrofurfuryl oleate, and other cyclic plasticizers.

[3] Includes data for adipic acid esters of monohydric alcohols, cellosolves, and glycols.

[4] Includes data for lauric acid esters of mono- and dihydric alcohols, and cellosolves.

[5] Includes data for methyl, ethyl, and butyl oleates, n-propyl oleate, glyceryl diacetyltartrate mono-oleate, glyceryl trioleate, and oleic acid esters of cellosolves and other alcohols.

[6] Includes data for tributyl, triethyl, and trioctyl phosphates, and for tributyl (cellosolve) phosphate.

[7] Includes ricinoleic and acetylricinoleic acid esters of mono-, di-, and polyhydric alcohols, and cellosolves.

[8] Includes data for sebacic acid esters of monohydric alcohols and cellosolves.

[9] Includes data for stearic, monohydroxystearic, and chlorinated stearic acid esters of monohydric alcohols, glycols, and cellosolves.

[10] Includes data for butyl and isopropyl myristate, polyethylene glycol esters of fatty acids, and esters of azelaic, citric, maleic, pelargonic, tartaric, and other acids.

Plasticizers Set New Records

by HENRY AVERY*

PLASTICIZER production and sales set new records in 1951, according to the United States Tariff Commission's annual report. Production soared to 280 million lb., an increase of more than 15% over the 242 million lb. produced in 1950. Sales in 1951 amounted to 210 million lb., valued at 84 million dollars, compared to 187 million lb. in the previous year, valued at 65 million dollars. Unit value averaged 40¢ per lb. compared to a 35¢ per lb. average in 1950. Actual plasticizer production in 1951 exceeded the 280 million lb.; the government figures reported in Table I do not include certain polyester and petroleum-derived extender-type plasticizers.

The difference between the 280 million lb. of plasticizers produced and the 210 million lb. sold in 1951 is accounted for by inter-plant transfers which are not included in this report, and by increases in inventory. These records were set in spite of shortages of raw materials such as phthalic anhydride, phosphorous oxychloride, adipic acid, and octyl alcohols. It is estimated that 1952 production will show another increase of 20 percent.

Vinyl Resins

The greater part of the phenomenal growth in the plasticizer

* Manager, Plasticizer Div., Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.

Table II—Vinyl Resin & Plasticizer Production Growth (1941-1951)[1]

Year	*Vinyl Resins, (lb.)*	*Plasticizers, (lb.)*
1941	22,980,000	53,436,000
1942	52,156,000	86,119,000
1943	95,564,000	112,231,000
1944	126,892,000	186,745,000
1945	122,708,000	170,225,000
1946	155,609,000	114,596,000
1947	177,443,000	148,101,000
1948	218,200,000	144,751,000
1949	267,686,000	165,963,000
1950	330,986,000	242,553,000
1951	475,778,000	280,385,000

[1]Source: United States Tariff Commission Reports.

Table III—Comparison of 1950-1951 U.S. Production and Sales of Plasticizers

Chemical	*Production* 1,000 lb. *1950*	*1951*	*% increase*	*Sales* 1,000 lb. *1950*	*1951*
Grand Total[1]	242,553	280,385	15.6	186,650	209,822
PLASTICIZERS, CYCLIC					
Total	179,867	203,385	13.1	136,665	151,613
	(74.0)[1]	(72 4)[1]			
Phthalic anhydride esters, total	142,582	157,225	10.3	104,250	114,189
	(58.7)	(56.1)			
Dibutyl phthalate	19,788	19,004	4.0	13,584	13,948
	(8.1)	(6.8)			
Di-2-ethylhexyl phthalate	60,537	64,861	7.2	14,734	45,345
	(24.9)	(23.1)			
Di-iso-octyl phthalate	2,595	8,278	219.0	2,837	7,526
	(1.1)	(2.9)			
Miscellaneous cyclic plasticizers	15,053	21,828	45.0	16,521	20,744
	(6.2)	(7.8)			
Phosphoric acid esters					
Tricresyl phosphate	15,311	17,255	12.7	15,516	16,680
	(6.3)	(6.2)			
Triphenyl phosphate	6,212	7,240	16.5	——	——
	(2.6)	(2.6)			
PLASTICIZERS, ACYCLIC					
Total	62,687	76,837	22.6	49,985	58,209
	(25.8)	(27.4)			
Adipic acid esters, total	5,965	7,113	19.2	3,374	4,574
	(2.5)	(2.5)			
Di(2-ethylhexyl) adipate	1,975	1,082	83.2	——	——
	(0.8)	(0.4)			
Di-iso-octyl adipate	1,206	2,455	100.3	——	1,346
	(0.5)	(0.9)			
All other	2,784	3,576	28.5	3,374	3,228
	(1.1)	(1.3)			
Phosphoric acid esters	4,887	9,240	89.1	4,266	6,802
	(2.0)	(3.3)			
Sebacic acid esters: dibutyl sebacate	2,258	2,812	24.6	——	——
	(0.9)	(1.0)			

[1] Percent of grand total is shown in parentheses below each total.

industry is due to the ever-increasing uses for vinyl chloride and copolymer resins, which on the average require one pound of plasticizer for every two pounds of resin. Table II (p. 85) shows vinyl resin and plasticizer production from 1941 through 1951. In 1941, production of all vinyl resins amounted to less than 23 million lb.; in 1951, it amounted to more than 475 million pounds. It has been estimated that production in 1955, based on announced expansions, will be on the order of 600 million pounds. Vinyl resins account for the largest segment by far of the synthetic plastics and resin produced during the year 1951.

With new uses appearing constantly and with established products being aggressively merchandised, sales are expected to continue their rapid growth. The use of vinyl resins in floor tile, embossed upholstery, garden hose, surgical tubing, food packaging, and rigid vinyl products, should account for a large part of the market increase anticipated during the next several years.

Production and Sales

From 1941 through 1951, the growth of the plasticizer industry has paralleled that of the vinyl resin industry. Plasticizers have become the indispensable ingredient which renders vinyl resins flexible and suitable for a wide variety of end uses. In 1941, plasticizer production was 53 million lb., as contrasted with 280 million lb. produced in 1951.

Table IV—Plasticizers Consumed (in pounds) by Vinyl Chloride and Copolymer Industry in 1951

Octyl Phthalate Plasticizers:	
Di 2-Ethylhexyl (DOP); Di-iso-octyl (DIOP); Dicapryl; Di-n-Octyl; Goodrich and Hercules combination phthalate types:	101,000,000
Other Phthalate Plasticizers:	
Includes Butyl cyclohexyl (Barrett's 50-B; Butyl benzyl (Monsanto Santicizer 160); and various hexyl phthalates and phthalyl glycollates:	5,000,000
Tetrahydrofurfuryl Oleate:	1,000,000
Phosphate Plasticizers:	
Tricresyl phosphate:	16,000,000
Other phosphates including Trioctyl (Flexil TOF); Octyl diphenyl; and Cresyl diphenyl:	12,000,000
Low Temperature and/or Special Purpose:	
Dioctyl sebacate: Di-2-ethylhexyl adipate; Di-iso-octyl adipate; SC (Drew); Dioctyl azelate and Glycol pelargonate (Emery's Plastoleins); Ricinoleates; Citrates; other miscellaneous special purpose types such as TWS that are unidentifiable by material content:	30,000,000
TOTAL:	165,000,000
Resinous Plasticizers:	
Polyester type, made like alkyd resins:	12,000,000

All the materials reported by the U. S. Tariff Commission as plasticizers, however, are not used as plasticizers for vinyl or other synthetic resins. Many of these synthetic organic chemicals have non-plasticizer uses such as jet-engine lubricants, non-flammable hydraulic fluids, fuel additives, all-temperature greases, rocket propellant fuels, air-filter dust collecting media, and insect repellants. These chemicals also are important in smokeless powder production, and large quantities were used for this purpose during World War II.

These non-plasticizer uses are expected to account for a large part of the new "plasticizer" production in the next few years. Estimates for their use as jet-engine lubricants range from 20 million to 40 million lb. per year. Tricresyl phosphate is being tested as an aviation fuel additive, and estimates of possible consumption in this field are in the tens of millions of pounds per year. Vinyl chloride and copolymer resin demands for plasticizers are also expected to continue to be high. It has been estimated that approximately 190 million lb. of total plasticizers reported for 1951 were used with PVC resins.

Present Market

The first six months of 1952 have seen a change from a seller's market to a buyer's market in most plasticizers. Manufacturer's inventories have increased because of greater production due to raw material availability and because of lower sales due to the reduction of plasticizer inventories in the hands of the consumers. Price trends have reflected lower raw material costs, particularly in the case of oleic acid and octyl alcohols. Tetrahydrofurfuryl oleate went from 37¢ per lb. to 27¢ per lb. and dioctyl phthalate was reduced from a high of 42¢ per lb. to 37¢ per lb. in June, 1952. The vinyl plasticizer sales anticipated for the third and fourth quarter of 1952, together with the other non-plasticizer uses mentioned before, should tend to bring production and consumption into balance.

Tariff Report Analysis

A comparison of part of the 1951 Tariff Commission report with the corresponding part of the 1950 report is given in Table III, p. 85. The plasticizer produced in the largest volume in 1951 was DOP (di-2-ethyl hexyl phthalate), production of which amounted to approximately 65 million pounds. All the phthalic anhydride esters increased 10%; of these, dibutyl phthalate decreased 4%; DOP increased 7%, although its percentage of the grand total dropped from 25% in 1950 to 23% in 1951. DIOP (di-iso-octyl phthalate) production accounted for only 2.9%

(*Continued on p.* 196)

HOT FOOD FOR FIGHTERS

Army food container, insulated with shredded urea foam, goes to the front in advance of field kitchens

U. S. Army Signal Corps photo

MILITARY authorities have long recognized that there is no substitute for hot food whenever it is possible to serve it to the troops. Often, however, fighting men in advanced positions are a long way from supply kitchens and must rely upon whatever field rations or emergency rations they can carry.

In an effort to meet this problem, the U. S. Army Quartermaster Corps has developed the M-1944 insulated food container, designed to keep foods and liquids palatably warm for at least 3 hr. at temperatures down to minus 20° F. The container has seen considerable service in Korea and has also proved useful in large military aircraft. The M-1944 insulated food container is now being produced for the Quartermaster Corps by Knapp-Monarch Co., St. Louis, Mo., well-known manufacturer of electrical appliances.

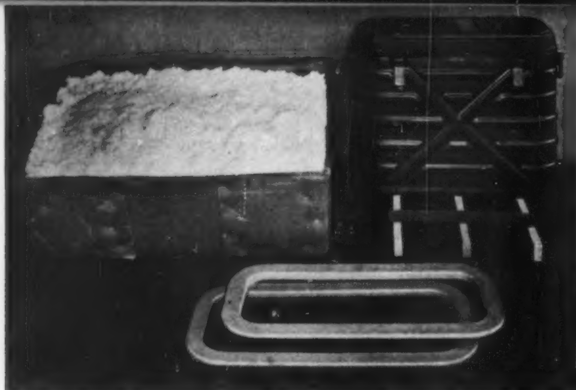
Three types of plastic materials play an important part in the construction of the container. These include urea foam insulation, used in the body and cover of the container; three supporting blocks of expanded Royalite copolymer material, which are located at the bottom of the unit, between the inner and outer walls; and laminated phenolic sheet, which is formed and used as collars for the container body and cover.

Removable Inserts

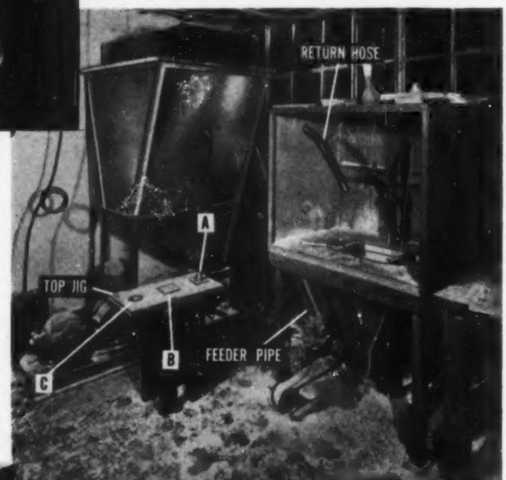
Food for the troops is placed in three removable inserts which fit inside the insulated container. The inserts are provided with bail handles which facilitate carrying and also retain the covers in position. The cover of the container itself is hinge mounted and held in closed position by passed-center latch assemblies. Drop handles on the ends of the container permit it to be carried easily.

Since the primary purpose of the container is to hold foods at an appetizingly warm temperature for long periods, the use of a superior thermal insulating material was imperative. U. S. Rubber Co.'s Flotofoam—a urea foam product—combines a number of important advantages, including light weight, excellent K factor, low moisture absorption, and other properties which have already led to its use for home freezer and refrigerator insulation by many firms.

Flotofoam's low specific gravity of only 0.8 lb. per cu. ft. eliminates unnecessary dead weight in the finished container, since only about 1.4 lb. of the material, in shredded form, is required for each container. The heat transfer factor of from 0.18 to 0.21 made possible superior insulating characteristics with minimum space between the container walls, thereby keeping the entire container as compact as possible and making more interior storage space available. The urea foam is also chemically inert under low temperature conditions and is not affected by long exposure to extreme refrigeration conditions. Odorless and mildew-proof, it will not support combustion; being non-corrosive, it will not react with metals



Food container (right) has urea foam insulation (left), laminated phenolic sheet collars, expanded copolymer supports



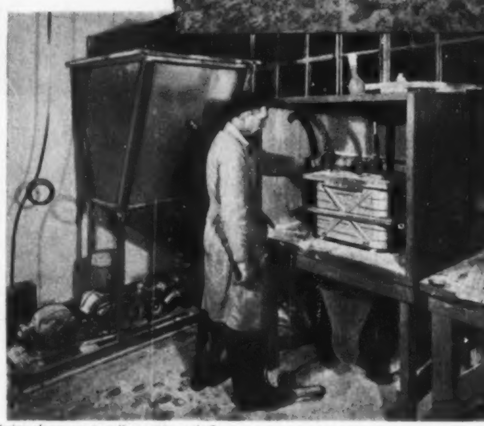
Blower cabinet has return hose to carry excess material back to supply hopper (left); top jig holds unit in place. A is return hose fitting; B is a cushion for the clamp; C is a screened hole to allow air to escape during blowing

when subjected to humid conditions.

Specifications for the M-1944 container require that the shredded plastic foam be used in the cover, side walls, and bottom of the unit. The insulation must completely fill the space between the outside walls of the body and the inner section, or well. The bottom space, except that occupied by the expanded Royalite support blocks, is filled flush with the outside body walls and overfilled to approximately ⅜ in. beyond the depth of the body walls, all of which are formed from sheet aluminum.

The urea foam material is supplied to Knapp-Monarch screened to about ¼-in. particle size. In order to obtain uniform distribution of the material between the container walls, the foam is blown in by air pressure from a hopper. Following assembly of the inner and outer shells with the expanded Royalite blocks separating them at the bottom, the container is inverted and placed in an open-sided enclosure, positioned so that it is directly over a large opening through which the insulation is blown by means of a fan located beneath the table. The operator applies a top jig which is clamped firmly down to hold the unit in place. He also inserts a hose through an opening in the top of the fixture so that excess material may be carried back to the supply hopper. The filling operation is controlled by a foot treadle.

Before final assembly of the cover, the space in the cover top is filled flush with the side walls and overfilled to approximately ¼ in. beyond the wall depth with the plastic foam. The overfill is compressed into the cover when the liner is assembled in order to prevent voids forming in the cover insulation.



Photos above courtesy Knapp-Monarch Co

Shredded urea foam is blown into the food container from the bottom; the operation is controlled by a foot treadle

The three expanded Royalite blocks used in the bottom of the food container measure approximately 9 by ¾ by 1¼ inches. They are secured in position with a solvent type cement which is not affected by temperatures within the application range of the container. The expanded polymer material is ideally suited to this application because it combines light weight, structural strength, and excellent thermal insulating characteristics.

Collars for the cover and body of the container, formed of $\frac{1}{16}$ in. laminated phenolic sheet, are supplied by Spaulding Fibre Co., Inc., Tonawanda, N. Y. Used in conjunction with neoprene gaskets, they seal the insulated walls of the container and help to provide a tight fit between body and cover, keeping heat loss at a minimum.

NEWS AND VIEWS OF PLASTICS PROGRESS

STOKES plastics review

VOL. 1

NO. 5

1952

PUBLISHED BY F. J. STOKES MACHINE COMPANY, PHILADELPHIA 20, PA.

New Pipe-producing Unit is Packaged for Profits

Ready for prompt delivery is a new PVC pipe-extrusion unit consisting of extruder, die, cooling unit, pulling rolls, and cut-off saw. An automatic stacking device can also be supplied.

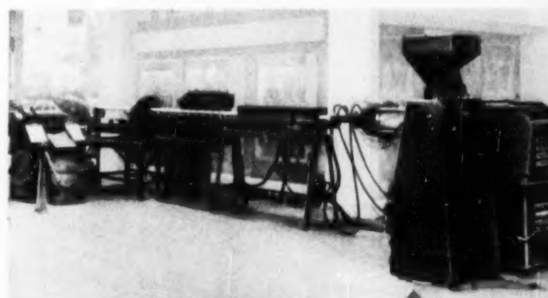
This new Stokes-Windsor unit makes pipe, from standard dies, up to 6 inches diameter, and in any length. Take-offs for larger diameters require special engineering. Wall thickness of pipe may be .050'' or less. Extrusion is done with either compounded or dry-blended material in a single operation.

Pipe is brought to precise dimensions and mirror-like finish, inside and out, either through a forming-box or a swaging die. The product becomes rigid as it passes through a water-cooled box.

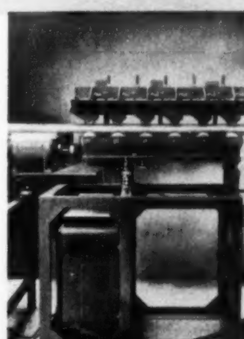
Pulling rolls are electronically controlled with infinitely variable speed, and precisely coordinated with the speed of extrusion to maintain uniform diameter. Upper idling rolls, spring-loaded, maintain uniform tension between pipe and pulling rolls. The constant rate of extrusion due to the unique action of the Stokes-Windsor multiple screw, coupled with positive pulling, assure a pipe of uniform diameter throughout.

The cut-off saw is clamped to the pipe and cuts the pipe to pre-determined lengths. Control is manual or automatic. In the latter case the pipe trips a limit-switch which actuates the clamp and saw and then returns the mechanism to its original position.

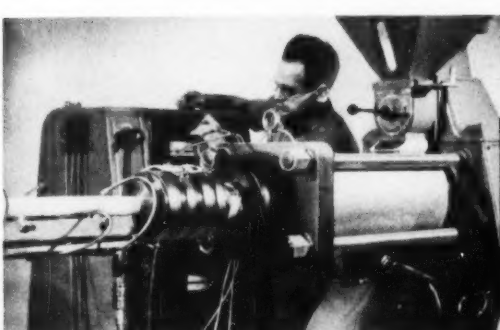
The Stokes-Windsor package extruding unit is furnished in three sizes, Model RC-65, RC-100, and RC-200, with nominal capacities of 65, 100, and 200 pounds per hour. Complete technical and engineering service covering design, material and installation, as well as training of operators, is part of the pipe extruder "package". There is a new completely descriptive bulletin available on request.

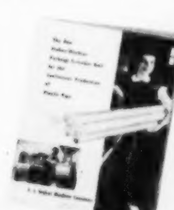


Overall view of Stokes-Windsor Extruder package unit for making rigid PVC pipe. Extruder and power unit at right; then forming-box, cooling-box, pulling rolls and cut-off saw.

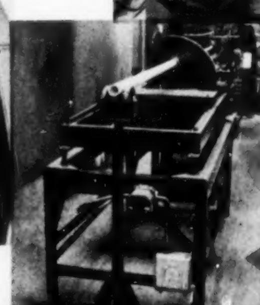


Pulling rolls below and spring-loaded idler rolls above. The latter insure even tension against pulling rolls.

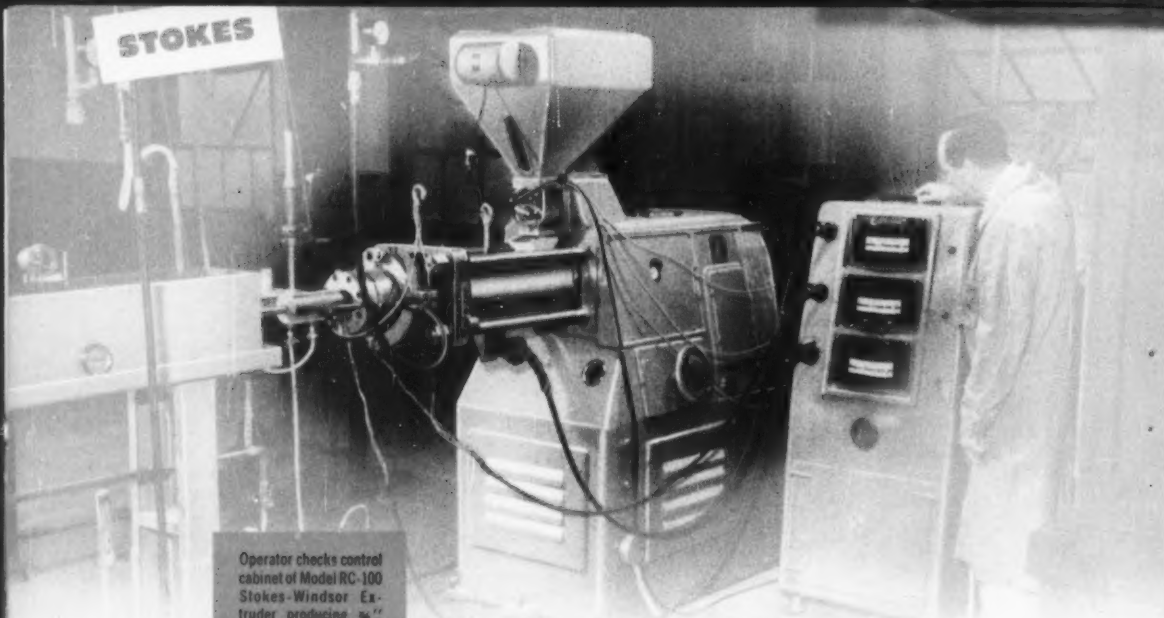




Send for your copy of new folder with complete description of the Stokes-Windsor Extruder Package



Table, carrying saw, clamps to moving pipe. At pre-determined length the saw, actuated mechanically or automatically, rises to position and cuts off pipe.



Operator checks control cabinet of Model RC-100 Stokes-Windsor Extruder producing ¾" rigid PVC pipe at Alpha Plastics Inc., in West Orange, N. J.

Alpha Plastics uses Stokes-Windsor Extruders to Produce Rigid PVC Pipe

Specializing in rigid PVC pipe, Alpha Plastics Inc., West Orange, N. J., is now producing pipe from ½" to 2" in diameter; 3" and 4" sizes will soon be added to the line as well as a complete line of PVC pipe fittings.

Tubing as thin as .040" is in production on the Stokes-Windsor Extruders. A unique feature of the machine is the multiple screws which deliver positive and constant pressure on the plastic material. There is a complete absence of pulsation, assuring uniform thickness and close tolerances.

Stokes-Windsor Model RC-100 is a medium capacity extruder with a nominal output of 100 lbs. per hour. A complete "package" unit for the manufacture of rigid PVC pipe is described on the preceding page of this issue.

Tips on Plastics Preforming

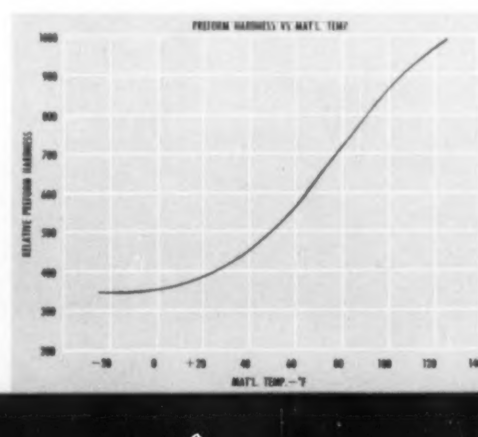
Though pressure and material are the major factors controlling density of preforms, there are other factors of importance. First of these is the handling of the drums of molding material as they come to the molding plant. Usually these leave the manufacturer uniformly mixed, but in transit there is a tendency for "fines" to rise to the top of the drum. Rolling or tumbling the drums of loose material before pouring the compound into the preforming press will eliminate this problem. Lubricant, if needed to help ejection from the mold, should be added before agitation of the drums.

Relative moisture of the molding compound is a second controlling factor on density. Overlong storage sometimes dries out the powder so that excessive pressure is required to make the preform. The correction is to add water vapor; then make provision in the molding cycle to de-gas the mold.

Finally: watch that temperature! Molding powder exposed to excessive heat in storage will be "over-ripe" chemically and too stiff in plasticity to process to advantage. However, temperatures below 60° to 65° F. should also be avoided. With such powder the preform may not hold together at all. The graph shows the relative hardness of preforms using powder at fixed pressure and varying temperatures.

The foregoing suggestions are drawn from the 20-page Stokes brochure, "Plastic Preforming", copy of which will be sent on request.

Courtesy: American Cyanamid Company.

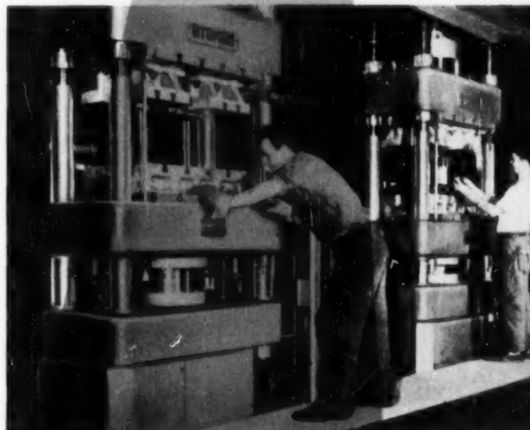


Kuhn & Jacob Speeds Production with New Stokes Presses

When the Kuhn & Jacob Molding & Tool Company was founded more than thirty years ago in Trenton, N. J., automatic plastics molding techniques were unknown.

First established as a tool and die business, Kuhn & Jacob gradually developed departments for plastics mold-making, compression molding, and finishing. Today, Kuhn & Jacob offers to its customers the benefits of many years of practical tool-making experience along with the technical knowledge necessary to custom-mold plastics that exactly fit their functional requirements.

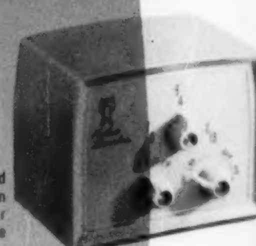
Over 100 plastics molding presses are in use at Kuhn & Jacob, ranging from 25 to 350 tons. Among the Stokes plastics molding presses are batteries of Stokes Models 727, 235-A, and 741. Model 727 is a 200-ton transfer molding press; both Models 235-A and 741 are 50-ton fully automatic compression molding presses. Together, the Stokes presses at Kuhn & Jacob assure high-speed, economical production, in large or small volume, of an infinite variety of custom molded plastic parts.



A pair of Stokes Model 727, 200-ton transfer molding presses at Kuhn & Jacob. These presses are unusual for their high speed and flexibility.

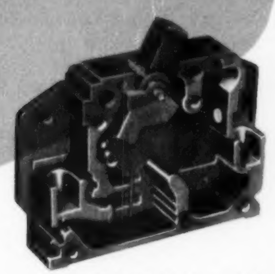
Bull Dog Pushmatic Circuit Breaker case molded on Stokes Model 235-A, 50-ton fully automatic hydraulic molding press from Beetle Molding Compound.

Roof of Model Railroad Station is molded on Stokes Model 727, 200-ton semi-automatic transfer molding press.

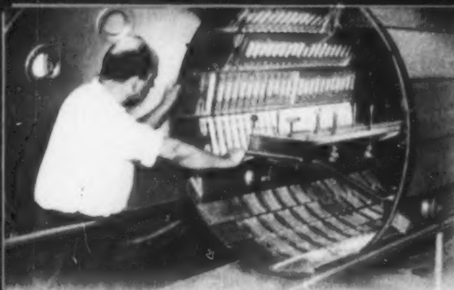


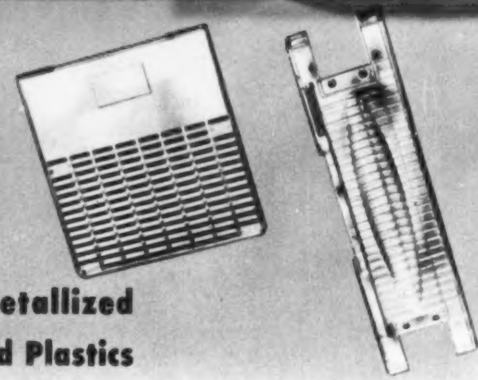
RMS Video Booster molded on Stokes Model 727, 200-ton semi-automatic transfer molding press from Beetle Molding Compound.

A battery of Stokes Model 235-A plastics molding presses at Kuhn & Jacob. These fully automatic presses operate 'round the clock and require only filling of the hoppers and removal of the finished parts.



ITE Circuit Breaker molded on Stokes Model 235-A, 50-ton fully automatic hydraulic molding press.



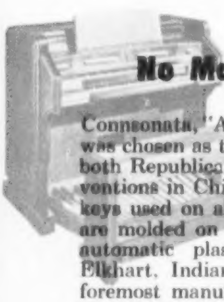


Radio Cabinet Parts Vacuum Metallized on Stokes Unit at Worcester Moulded Plastics

The crystal polystyrene grill and top of the radio cabinet of a nationally known manufacturer are vacuum metallized at the rate of 3,000 per day at Worcester Moulded Plastics Company, Worcester, Mass., on a Stokes Model 426 vacuum metallizing unit. Principal objective of the firm is to produce a quality metallizing job; even the die used to produce a perfect mirror finish on the solid section of the grill at the top has been given an optical surface true to within two millionths of an inch. No hand buffing operation is required after the brilliant finish has been applied.

The Stokes Model 426 vacuum metallizing unit at Worcester is completely self-contained. Its chamber measures 60 inches in length and 48 inches in diameter. It is furnished with the gages, valves, pump and other elements of the Stokes Microvac pumping system.

Founded in 1939, Worcester Moulded Plastics Company is a concern devoted exclusively to the custom molding of plastics. The firm designs and produces all of its customers' dies with precision workmanship. Specially developed equipment is available for every injection molding requirement. Presses include the largest injection molding press in the world, designed and built by Worcester Moulded Plastics.



No Matter Who's Elected Connsonata Called the Tune!

Connsonata, "America's finest electronic organ", was chosen as the official organ to be played at both Republican and Democratic political conventions in Chicago. Specially designed plastic keys used on all Connsonata electronic organs are molded on two Stokes Model 250-A semi-automatic plastics molding presses at the Elkhart, Indiana, plant of C. G. Conn Ltd., foremost manufacturer of band and orchestra instruments for more than seventy-five years. Molding the keys in one piece from plastics molding compound assures that the keys of Connsonata organs will never peel and spoil the appearance of the organs.

A separate, fully-enclosed molding room at Connsonata is used for making the organ keys. Air in the room is scientifically controlled. After molding, each key is placed in a cooling fixture to ensure perfect alignment.

All musical tones in the Connsonata organ are created by electronic means without benefit of moving mechanical parts in the tone production circuit. Connsonata's unsurpassed musical excellence is recognized by expert organists and critical laymen everywhere.

Plastic keys being molded at Connsonata Division on a Stokes Model 250-A plastics molding press. The process of molding the keys as a single piece assures Connsonata that the keys will never peel with age.

STOKES

F. J. STOKES MACHINE COMPANY
5534 TABOR ROAD, PHILADELPHIA 20, PA.

STOKES MAKES Plastics Molding Presses / Industrial Tabletting and Powder Metal Presses / Pharmaceutical Equipment / Vacuum Equipment / High Vacuum Pumps and Gages / Special Machinery

Saran Spreads Out

NOW add saran to the list of man-made fibers. Known for 100 years, saran, or vinylidene chloride, was introduced commercially by The Dow Chemical Co., Midland, Mich., only 13 years ago. Its uses in chemical pipe, in packaging film, for window screens, and especially in woven monofilament form for automobile seat-covers and for furniture coverings, are already well known applications.

To these applications saran brings its inherent properties of chemical resistance, and resistance to mold, mildew, and fungus growths. The material does not corrode, it is non-flammable, and it is unaffected by high and low temperatures. It is reported that approximately 90% of current saran production is going into monofilaments for screens and fabrics; however, now that saran multifilaments and fibers have been developed to a commercially practical point, Dow is increasing production of the basic material.

During the past five years, while conducting research and development work on saran monofilaments, Dow has also been working on fine saran filaments. A similar program has been carried out by The National Plastic Products Co., Odenton, Md. Now the results of these two programs have been pooled, and an associate company has been formed—The Saran Yarns Co., also located at Odenton. This company will carry on further development of fine denier saran yarns, and will produce these yarns on a commercial basis.

Forms of Fibers

The new saran fibers will be available in the form of continuous multifilaments, staple, top, spun yarns, and saran tow—in thicknesses of 10 denier and up.

Continuous saran multifilaments will be used in the production of woven industrial textiles where resistance to acids, most alkalies and/or solvents, are required. They may also be used in special types of upholstery of drapery fabrics for use in public buildings, buses, trains and other places where long wear and non-flammability are prime requirements.

Saran staple has an inherent curl, but may also be produced in straight form. Predicted uses are in felts of all kinds, heavy lining materials, and duck-like fabrics. In the home, saran staple—either 100% or in blends—will find use in blankets, carpets, draperies, and upholstery.

Saran top is a carded staple fiber representing an intermediate state in changing staple fiber to yarn, for weaving worsted-type or woolen-type fabrics. The resulting yarns may be used on conventional warping and weaving equipment to produce fabrics for suiting, gloves and socks—even carpets and upholstery.

Saran tow, a continuous straight fiber with an appearance similar to that of silk, also has some indicated uses in upholstery and drapery materials; largest current market is in doll and mannequin wigs.

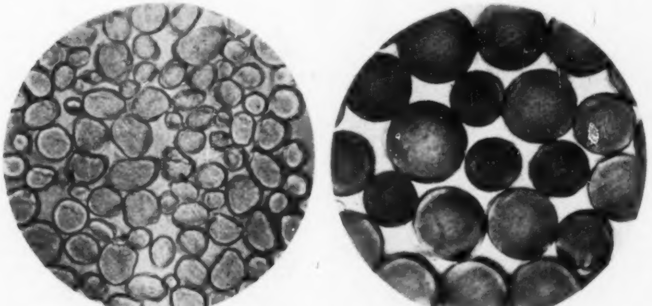
Saran staple fiber. Note inherent curl

Engineered Blends

As in the past, fabrics of the future will benefit greatly through the development of man-made fibers. Obviously, no one fiber will do everything. Blends will be engineered to meet given specifications, and it is certain that the new saran fibers will take their rightful place in future developments.

The inherent curl of saran fine filament fibers is indistinguishable from that of wool, even to experts, except under a microscope. As blend fibers, the straight or curled forms are compatible with a variety of both natural and other synthetic materials. They are made with built-in color and no surface dyes are used. They need no pre-treatment or post-treatment. They have excellent abrasion resistance, a high softening point of from 240 to 280° F., and very low thermal expansion.

Supplies of the basic processing materials for saran are good, and within the next few weeks The Saran Yarns Co. expects to make a public presentation of the new fibers in commercial applications.



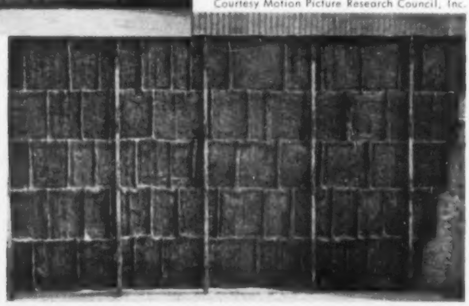
Photos courtesy The Dow Chemical Co.

Photomicrographs of wool (left) and saran fiber (right), illustrating the irregular cross-section of the natural fiber, and regular cross-section of the synthetic fiber

On Stage . . .

Fig. 1—Front (left) and back (below) of housing shingle prop where impact strength of reinforced polyesters permits production of thin casting

Courtesy Motion Picture Research Council, Inc.



STAGE, screen and television producers see in plastics a new star. So successful has this performer been, that first casting call for structural units, set props, and other equipment goes to plastics. To these applications plastics bring improved performances based primarily on mechanical strength, durability, light weight, and workability. As a result, plastics are leading to the rapid upstaging of plaster, wood, glass, and other materials formerly used in great quantities for the same purposes.

Plaster, long used in large volume in stage sets and props because of its low price and simple fabrication methods, was widely replaced. Reinforced polyesters, cellulosic compounds, and polyethylene could do the same jobs and had none of plaster's disadvantages of low chip resistance, brittleness, poor weathering properties, and excessive weight with resultant high costs for transportation, supporting structures, and rigging.

Polyesters Used Extensively

Reinforced polyester resins are the largest volume plastic now used to fabricate structural stage units of all sizes—from brick walls and giant trees to all kinds of decorative props and miniatures. The movie industry alone consumes an average of 75 tons of polyester resin per year. Yielding light-weight shapes of extreme mechanical strength and excellent detail fidelity, the reinforced polyesters are being widely used in "practical" props (as opposed to decorative) where their high impact strength assures long service life and permits production of thin yet strong sections (Fig. 1).

Standard production processes are used in molding stage props from reinforced polyesters. Some of the molds used include rigid plaster or polyester molds (Fig. 2), elastomeric

Courtesy Studio Alliance, Inc.

Fig. 2—Two-piece polyester mold (left) was cast from actual mail box. Finished polyester prop (right) for T.V. set weighs only 13½ lb.

Fig. 3—Three-piece mold for fire hydrant made from life-size replica (left) consists of polyester shell lined with elastomeric vinyl

with Plastics

Courtesy Studio Alliance, Inc.

Fig. 4—Glass tape wrapped around tree and saturated with polyester resin prevents brittle limbs from snapping

vinyl molds, or a combination of both (Fig. 3).

For structures that require individual modeling—rocks, trees, circus floats—layers of impregnated mat are laid up over wood or wire frames, formed manually, and cured. Studio Alliance, New York, N.Y., is doing an unusual job of covering small trees with glass tape and polyester resin (Fig. 4) to produce permanent props.

In most prop work, polyesters are used in their natural color and then the structures are painted for individual needs. When desired, color can be incorporated in the resin to produce props with "built-in," permanent color effects.

Examples of typical prop units being produced for the stage in reinforced polyesters are illustrated in Figs. 5 and 6.

Other Light-Weight Structures

For fabrication of durable light-weight props, a colloid treated material called Celastic is now widely accepted. This material, produced in sheet form by Celastic Corp., Arlington, N.J., and distributed by Ben Walters, Inc., New York, N.Y., consists of cotton cloth impregnated with cellulose nitrate and a fire retardant. Production of a Celastic prop is illustrated in Fig. 7.

Celastic props, which are weath-

Fig. 5—Group of polyester props for television. Ornate column (right) is made by assembling individual molds for base, cornice moldings, bust, and simple column. Gilded bust (center) weighs 1 1/2 lb. and replaces the original which weighed 14 lb. Rock formation (center bottom) utilizes the mechanical strength of reinforced polyesters for "practical" units

Courtesy Studio Alliance, Inc.

Fig. 7—Decorative scroll is made by soaking strip of Celastic in solvent until it becomes entirely flaccid and then molding it against a metal form. Upon evaporation of solvent, which takes about 20 min., material becomes rigid, retaining shape produced during the forming operation. Metal mold is then removed and scroll painted

Courtesy Ben Walters, Inc.

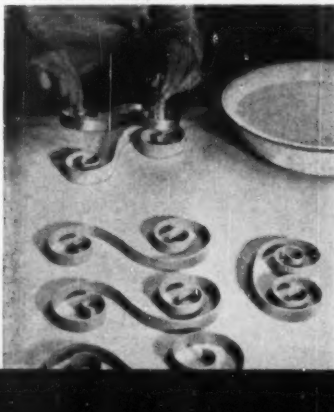


Fig. 6—Typical props for the movies include rock column and brick and stone wall units

Courtesy Motion Picture Picture Research Council, Inc.

Courtesy Ben Walters, Inc.

Fig. 8—Mask and horseshoe with metallized tips, made of Celastic, used by the Metropolitan Opera

Courtesy Ben Walters, Inc.

Fig. 9—Float and life-size statues in Ringling Brothers, Barnum & Bailey Circus are covered with layers of Celastic. Wooden and metal frames are scrimmed over with Celastic sheets, then painted with casein paints which can be washed off when desired

er-resistant, can be sewn through as well as metallized. Thus it is particularly suitable for headdresses, armor, medallions, jewelry, and masks (Fig. 8). The material is also used as a protective covering for circus floats (Fig. 9).

Light-weight helmets, armor, and similar historical props for movies and television are frequently fabricated from cellulose acetate and ethyl cellulose sheets using hot drawing techniques, or by simply tacking in place over curved frames.

Cellulose acetate in large seamless sheets is being used in the movies for background process screens and translucent scenic backings. The method of making the sheet, developed in Hollywood studios, consists of spraying a mixture of cellulosic material, plasticizer, and solvent against a resin-impregnated canvas sheet which serves as a matrix. After the sheet is dry, it is stripped off the matrix and mounted on a frame.

An important use of polyethylene in movie set production is in forming structures with compound curves, such as stair-rail easements. The piece is first produced with straight surfaces and then, by reheating selected parts to about 250° F., the curves are formed to the desired shape, which is maintained when the piece cools.

Modified Plaster

Some plaster-type materials for props have not yet been replaced by plastics, but are usually improved by the incorporation of synthetic resins. Plaster fortified with urea-formaldehyde resin has good tensile and impact strength, permitting thinner casts. It has become a preferred material for duplicating detailed moldings (Fig. 10) and for building cornices, steps, and other units exposed to scuffing or wear.

Other improved plaster formulations incorporate emulsions of vinyl, methacrylate, styrene, and the copolymers.

Glass Replacements

Acrylic has largely replaced glass on stage and in movie and television sets because of its light weight, resistance to breakage, and good clarity. Chandeliers, for example, for the Metropolitan Opera and a

Fig. 12—To form bubble-like headgear for T.V. science fiction program, two sheets of acrylic, each 3/16-in. thick, are blown into hemispheres and bolted together

Courtesy American Broadcasting Co.

Fig. 13—Flexible vinyl mold is used to make polyester sunburst which has undercuts. Plaster model of sunburst, embedded face down in mold, will be removed through back of mold (shown being cut away) and polyester impregnated glass laid up inside

Courtesy Studio Alliance, Inc.

Courtesy Motion Picture Research Council, Inc.

Fig. 10—Many of the detailed moldings and intricately curved pieces for motion picture sets, such as the period window frame pictured here, are cast from plaster reinforced with urea-formaldehyde resin. They replace the higher priced wooden moldings

Courtesy American Broadcasting Co.

Fig. 11—Clarity of acrylic window is utilized in close-up of television's Tom Corbett, Space Cadet, at work in his spaceport

number of Broadway shows are assembled of formed rods and tubes, with molded acrylic pendants.

Windows in television sets are frequently acrylic (Fig. 11) if they must stand close inspection. Heavy acetate sheets can be used if they are seen from a distance. Frosted panes are made of Du Pont's Cel-O-Glass—galvanized wire coated with cellulose acetate.

Acrylic also goes into such science fiction props as futuristic apparatus, space ships astradomes and blisters, etc. The headgear in Fig. 12 was made by Just Plastics, New York, N. Y., from Plexiglas.

Outdoor backings of wood, plaster, or concrete, on which scenery is painted, are often coated with a vinyl water-base paint which forms a tough, continuous film upon drying. This protective coating has a high degree of weathering resistance and prevents cracking and chipping of the painted backings.

Specialty Uses

While the predominant use of plastics in stage props is for structural purposes and centers around the fabrication of rigid articles and units, a variety of materials have solved non-structural problems.

The flexible vinyl mold, for example, has practically taken over the function of the glue mold for producing cast plaster and polyester props because of its toughness, flexibility, and inertness to humidity changes (Fig. 13). It is also replacing the rigid plaster mold except for relatively large castings. The movie industry uses an annual average of 25 tons of polyvinyl derivatives for such molds.

Elastomeric vinyl is also being used for ornaments, architectural details, and costume trim, usually being produced in flexible vinyl molds (for undercuts) or polyester molds.

A specialty vinyl fabric, sold by Dazian's, Inc., New York, N. Y., under the name of Gleam, has provided the theater—and particularly the circus—with a decorative material that has the shine of metallic fabric but that won't tarnish, that weathers well, and that can be sewn through and cleaned with a damp cloth. Gleam is a laminate consisting

(Continued on p. 181)

Fig. 15—Hanging mobile made from 15 to 20 gage acetate sheet and acrylic rods reflects rich colors of spotlight better than gelatin sheets commonly used over colored spots for this purpose

Courtesy Monsanto Chemical Co.

Fig. 14—Glassware, cast or slush molded from specialty styrene breakaway compounds, has property of extreme brittleness; on impact, it shatters into fragments with completely dull edges

Courtesy Motion Picture Research Council, Inc.

Phenolic Duplicating Masters

Quick-curing casting resin replaces steel in production of multi-cavity molds from original models

Fig. 1—Pouring liquid casting resin, to which a special hardening agent has been added, into a form box which contains a lead model of the object for which a multi-cavity steel mold is to be made. The lead model and the inside of the form box have previously been coated with clear lacquer as a parting agent

Fig. 2—After sufficient liquid resin has been poured into the form box to completely cover the lead model, the box is placed in an electric oven for a two-hour bake

WHENEVER molds are to be produced by duplicating or pantographing, the first step is the manufacture of a master. Generally made by a highly-skilled model maker from a drawing, the master is an exact replica of one side of the part to be molded. It is either the same size as the part, if it is to be used with a duplicator, or two or three times larger, if a pantograph is to be used.

There is great risk of damage to the master during duplicating if wood, plaster, or other fragile materials are used in its manufacture. Sometimes if only a single-cavity is to be made, the tool maker can get away with a plaster master cast from a wood model, but in the case of multi-cavity molds which require the repeated scraping contact of a stylus across the master surface, there is not even a remote possibility that it will stand up unless it is made from a rigid hard-surfaced material. Accordingly, most mold makers specify a hardened steel master, which means that the model maker must work directly in steel. If cavities are to be duplicated or pantographed, a male model must be machined and a female master produced by hobbing. All of this is very expensive; it requires about three times the man hours to produce a steel master as to make a wooden one.

Hard Material Needed

This situation naturally caused tool makers to attempt to find a material which could be cast around a wooden model, be strong enough and hard enough to withstand repeated scrapings from the stylus of a pantograph or duplicator, and at the same time have a minimum of shrinkage. The Banner Mold & Die Corp., Leominster, Mass., has found one solution to the problem. They are now pantographing many of their single and multi-cavity molds

using a master cast from a special, quick-curing liquid phenolic casting resin, furnished by the Marblette Corp., Long Island City, N. Y. This tool company's model maker now works directly in wood, and after pre-sealing the finished wood surface to eliminate any possibility of porosity, delivers the finished model to Banner. In many cases the liquid phenolic material can be cast directly around the wood model; however, according to the Marblette engineers, a lead model is more satisfactory. Accordingly, a plaster female is cast around the original wood model. Lead is then poured in the female plaster casting, and a male lead model results.

The illustrations herewith show the remaining steps in the master and mold making process, the procedure being the same whether a wood or lead model is used.

Two Hour Bake

A form box and the model are given a thin coat of clear lacquer, which serves as a suitable parting agent. The model is then placed in the bottom of the form box (Fig. 1), after which the water-clear liquid Marblette resin (with a special hardening agent already added) is poured into the box, covering the model completely. The form box is then placed in an electric oven (Fig. 2). Two hours of baking at a relatively high temperature completes the cure, after which the casting is allowed to cool to room temperature.

After cooling, only a slight tap on the bottom of the box is required to eject the cured phenolic master. Figure 3 shows the lead model and the female master. The master is next mounted on the pantograph (Fig. 4) and the operator proceeds to machine the multiple cavities of an injection mold in one piece of steel. The illustrated operation, known as pantographing, requires that the operator manually move the stylus over the entire surface of the master many times for the production of even one cavity. The same master is used for all the cavities and hence, if the cavities are to be identical in every respect, the details of the master must not be changed in the least by the repeated contact of the pantograph stylus.

Figure 5 shows a partial test shot from the multi-cavity mold shown in the background in Fig. 4.

Fig. 3—After the core box and its contents are taken from the oven and allowed to cool, the lead model is easily removed from the cured phenolic master. Lacquer coating insures quick, clean release

Photographs courtesy Marblette Corp.

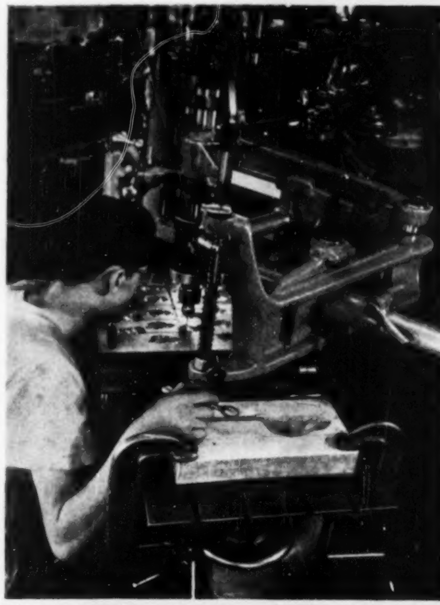


Fig. 4—With plastic master securely clamped in place on pantograph, the operator skillfully moves the ball-point stylus over all the contours of pattern. As this is done, pantograph cutter produces precision cavity in steel plate in background

Fig. 5—Partial test shot (below) produced in the multi-cavity mold shown being produced by pantographing in the illustration at the left

Pins and clips for fastening scarves, hoods, or other headgear in place are no longer necessary when using this one-piece headband molded of clear Tenite I cellulose acetate. Molded with a smooth, chipproof surface, the headband lies hidden between the folds of the head covering and acts as a handy and convenient anchor. Even after long usage, the durable band will retain its shape and flexibility. It is molded by The Jamison Plastic Corp., 71 East Sunrise Highway, Freeport, New York, for Anchorchief Co., Inc., 49 W. 32 St., New York 1, New York

Educational toy for youngsters from 3 to 11 years of age consists of 160 die-cut vinyl pieces which can be arranged and rearranged on a display board to form a wide variety of shapes. The pieces are of 18 to 20 gage press polished calendered vinyl and will adhere to the cellulose acetate laminated board without the use of an adhesive. They can easily be removed from the board and used over and over again in creating new figures and designs. The toy, called "Make-A-Shape," is produced by Stanley Plastic Products Co., 87 Browne St., Brookline 46, Mass.

PLASTICS

Cellulose acetate flower clip will hold a corsage firmly in place on the wrist for an entire evening. The lightweight clip, made of 0.040 extruded polished Kodapak I sheet, slips easily over the wrist and has several metal fingers which can be bent around the flowers to hold them in position. A similar series of clips is available to be used for bare shoulder wear with strapless evening gowns and for headwear. Clips are by Rex Kaber Mfg. Co., Campbell, Calif.

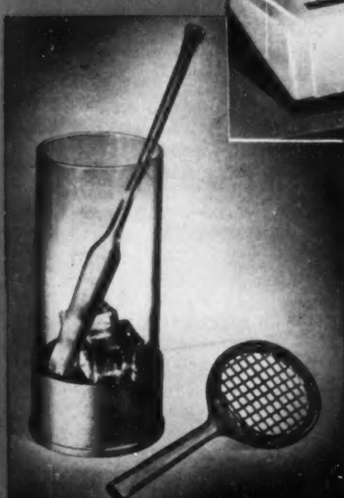
Colorfully painted styrene figurine of a Colonial maid, 6 in. high, opens up into three sections to reveal a handy and decorative sewing kit. The center section of the figure is fitted with a pin cushion; the bottom half, or base, is a deep compartment for holding pins, snaps, and other similar accessories. Eight spindles for holding spools of thread are molded-in as part of the bottom tray. The kit comes fitted with thread, needles, and a styrene thimble. Made by Dart Craftsman Corp., 240 Madison Ave., N.Y. 16, N.Y.

PRODUCTS

High impact strength of Tenite II cellulose acetate butyrate provides a durable handle for a screw driver with a 6 in. steel blade. The handle is noncorrodible, impervious to perspiration and most oils and greases, and, because of the low heat conductivity of Tenite II, remains always pleasant to the touch. Attached to the handle end is a removable Palm-Grip ratchet for greater leverage and better control. Handle is extruded by Rotuba Extruders, Inc., 437 88 St., Brooklyn 9, N.Y. for Kipton Industries, Kipton, Ohio

Attractively styled reversible raincoat, snap fastened and designed with big, roomy pockets on either side, is made of lightweight Vinylite plastic, pin-dotted and embossed to give the look and feel of fine fabric. All seams are electronically sealed. The rain coats are available in three sizes—small, medium, and large—and in addition to the pin dot pattern are furnished in a wide variety of plain color combinations including navy-white, red-navy, and brown-beige. Made by Main Street Rainwear, 257 W. 39 St., New York, New York

Bread box, molded of polystyrene, can accommodate two average sized loaves of bread. When the top cover is raised, the box opens wide to provide easy access to the bread. Boxes are available in two 2-color combinations—a red base with opaque white cover and a yellow base with opaque white cover. A decorative label is molded-in on the top cover. Boxes are molded by Rogers Plastics Corp., West Warren, Mass.



Unique replicas of sporting equipment make up a three-piece bar set appealing to sports fans. Included in the set are a 7½ in. high mixer fitting into a polyethylene base to simulate a shotgun shell; a styrene canoe paddle serving as the stirrer; and a styrene miniature of a tennis racquet which doubles as a strainer. The set, available only in red, is distributed by Charles H. Greenlee, 225 Fifth Ave., New York 10, N.Y.

PLASTICS Merchandising*

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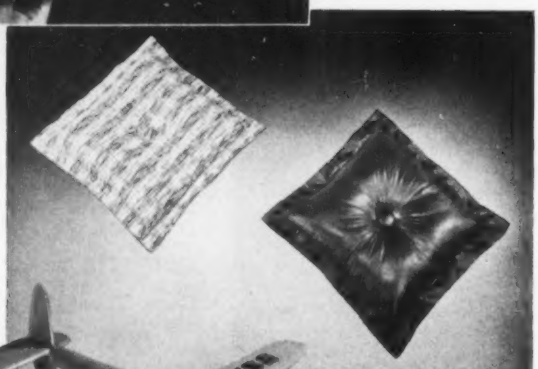

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1 **Light diffuser**—Soft, evenly distributed lighting is attained by clipping molded polyester-Fiberglas light diffuser onto ceiling bulbs. The diffuser is a shallow cone, 14 in. in diameter, and is strong and tough enough to be cleaned in a dishwashing machine.

Lam Work-hop, Inc., 316 Washington St., Brookline 46, Mass.

2 **Cushions**—Decorative bed and chair cushions of 4-gage vinyl are available in two textures—solid color embossed satin taffeta finish and a 3-color print on deep-formed vinyl simulating a plaid effect. The cushions, 15 by 15 in. with 1¼ in. tailored edge on all four sides, are waterproof, sunproof, will not crack or peel, and can be easily washed or wiped with a damp cloth. The cushions retail for 98¢.

The Weiss & Klau Co., 462 Broadway, New York 13, N. Y.

3 **Plane replica**—Toy replica of the Fairchild XC-120 pack plane is molded of medium impact styrene. Cargo doors on the plane open and close for loading and unloading model styrene tank and jeep which come with the plane. Wingspan is 10½ in., over-all length 8 in., and height 2¾ inches. The plane is available in red and crystal and silver grey and crystal.

Swadar Plastic Co., 887 Ridgeway Ave., Aurora, Ill.

4 **Condiment Tray**—Seasonings may be handily served in the all-styrene "Flavor-Server," which consists of two square bowls that fit into a tray, a spoon for each bowl, and a lid which covers the two bowls together. Side slots in the bowls permit the spoons to stay inserted while the lid is on. The tray is available in either chartreuse, maroon, wine, or green and the entire unit is attractively packaged in Pliofilm.

Plastic Metal Co., 3550 N. Spaulding St., Chicago 18, Ill.

*Reg. U. S. Pat. Office

5 **Glasses**—One-way novelty glasses permit the wearer to see through the material but completely obscure the eyes of the viewer. The glasses are fabricated from 20-gage translucent metallic acetate.

Clearsite Corp. of America, 34 W. 4 St., New York 12, N. Y.

6 **Steam iron**—Large steam control knob of red and handle of brown Bakelite phenolic with both left and right thumb rests are steam iron's features. The steam valve "on" and "off" switch and the fabric setting dial is controlled by one finger.

Hoover Co., North Canton, Ohio.

7 **Card holder**—For card enthusiasts, a Lustrex styrene card holder will keep a bridge or canasta hand organized and easy to read. The cards, when inserted fan-wise, will stay in place and are easily removed. Holder is available in transparent colors with an embossed gold leaf design. Retails for $1.

Eastern Plastics, Inc., Kenwood Ave., Fairfield, Conn.

8 **Apron**—Children's pinafore style vinyl apron is patterned with a small floral print and candy stripe ruffle trim. It is available in sizes 2-4 and 4-6 and in a wide assortment of colors.

Paradise Mfg. Co., 3669 Whittier Blvd., Los Angeles, Calif.

9 **Bread box**—Air tight polystyrene bread box prevents excessive drying and keeps bread fresh for one full week or more. The crystal clear styrene box is shatterproof, easy to clean, and odorless. It is conveniently loaf shaped, 12¼ in. long, 5½ in. wide, and 5 in. deep. The lid is equipped with a styrene handle, in either red or yellow.

Tri-State Plastic Molding Co., Inc., Henderson, Ky.

10 **Water pistol refill**—For water pistol totin' youngsters, a handy styrene refill case holds enough water to provide a convenient source of "ammunition." A metal clip fastened to the back of the case allows it to be easily attached to the belt or shirt. Inserted into the top of the case is a polyethylene plug which is removed to provide access to the water.

Plast-O-Matic Corp., Fitchburg, Mass.

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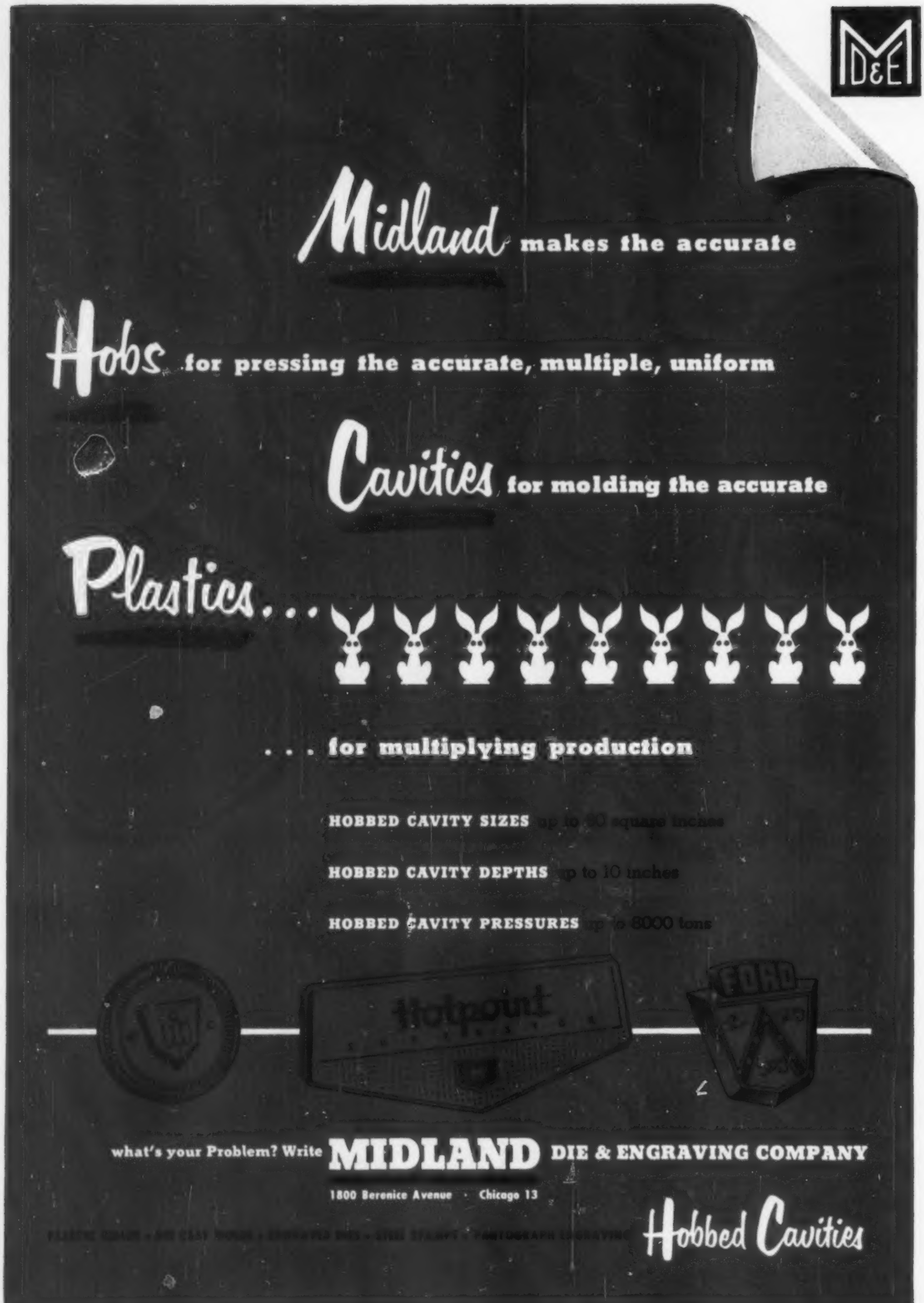
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Hobbed Cavities

Sprayed Metal Molds

by DR. WALTER BRENNER[†] and LEOPOLD HASE[†]

THE application of metal spraying techniques for the production of low-cost molds opens up many novel and interesting possibilities, especially to users of low pressure molds. A metal spray mold forming process has been developed which makes feasible the more economical production of high quality molds for such diverse industrial applications as plastics sheet forming, slush casting, paint masks, low pressure laminates, etc.

The rapid and accurate production of both single and multiple cavity molds with even complex shapes and stringent dimensional stability requirements can be carried out with a minimum of skilled labor and without the need of expensive machinery.

The metal spray mold forming process is carried out by spraying molten metal onto a master until a shell of predetermined thickness is formed. This shell is then removed from the master and readied for service by backing it up with any one of a number of suitable materials, such as a variety of commercially available plastic casting resins, low pressure polyester laminates, gypsum cements, etc.

Production Techniques

The production of molds by the metal spray shell mold forming process involves the following operations, which can be executed in the sequence listed, after having decided on the physical properties which shall be required of the sprayed metal shell molds for any specific application:

1) Selection of a suitable master model; 2) making the master; 3) preparation of the master surface for metal spraying; 4) mounting the master before spraying; 5) metal spraying onto the master until the desired shell thickness is obtained; 6) removing the sprayed shell from the master; 7) backing up the spray formed shell; 8) mounting the spray formed shell for use.

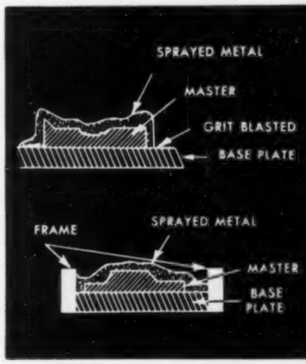
Selection of Master Model

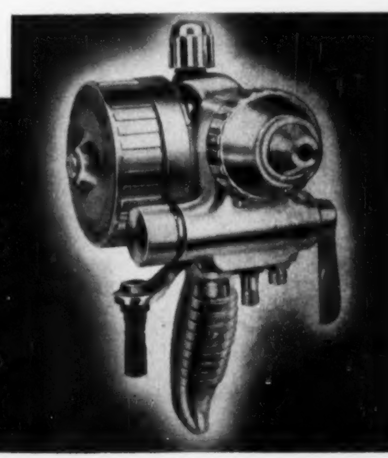
The selection of a suitable master model is of the utmost importance for the production of high quality metal shells, since the sprayed metal will reproduce the face of the master model with great accuracy. The very texture of the surface of the master model—including even sandpaper scratches or the pores of a gypsum cement structure—can be faithfully reproduced in the face of the sprayed metal form. Since no molded part can be better than the die from which it has been produced, the amount and quality of detail desired in the sprayed metal mold must be produced first on the face of the master model. Care and time spent in the preparation of the master surface will yield ample dividends in the form of high quality shells.

Although accuracy of detail is a prime requirement, the master model should also possess sufficient mechanical strength properties to successfully withstand any strains which may develop during the spraying operation. The nature of the metal to be sprayed is another factor which has to be considered.

Only a small fraction of the heat which is required to obtain a fine spray of molten metal is retained by the metal particles as they strike the surface of the master model. This is due in a large measure to the cooling effect of the blast of compressed air which projects the molten metal particles against the surface to be coated. The rise in temperature of the work depends on such variables

Fig. 1 (below)—Edges of sprayed metal may be tied down by grit blasting the base (top) or use of a frame (bottom). Fig. 2 (right)—Model 4E spraygun





* Reg. U. S. Pat. Office.
† Project engineer, Dept. of Chemical Engineering, Polytechnic Institute of Brooklyn.

Fig. 3—Metal spraying installation, with master mounted on a turntable

as the distance of the spray gun from the master model, area of the master, rate of metal deposition, length of spraying process, type of spraying equipment used, and individual variations of spraying technique, as well as on the physical properties of the metal sprayed. Generally speaking, more heat will be developed when spraying with high melting point metals and alloys such as steels, nickel, etc., than with zinc, tin, lead, and other lower melting materials, provided that all other spraying conditions be kept constant.

Work temperatures of up to 400 or 500° F. have been recorded after continuously spraying ⅛ in. diameter steel wire into a fairly confined area for about ½ hr.; 250 to 350° F. temperatures were noted under similar spraying conditions for an equally sized tin-lead alloy. For best results, work temperatures should not exceed 150 to 200° F. in order to minimize thermal distortion of both the master model and the sprayed metal deposits. The temperature rise of the work can be easily controlled by adopting an intermittent spraying technique, i.e. frequently stopping the spray to allow the master to cool. The periodic application of a blast of compressed air to the work piece is a most effective work cooling technique. Water from a hose can also be trained on the work.

The choice of the material for the construction of the master model is especially important when the master model is to be produced from a material which possesses a low melting point or is subject to a considerable amount of thermal distortion. In such cases, the possibility of employing a master model material with a higher melting point should be considered. Should such a substitution prove impractical, the use of an intermittent spraying technique and an occasional brief air blast will suffice to prevent damage to the master.

It should be emphasized that many low melting materials have been and are being employed as masters for metal spraying operations. It is entirely feasible, for example, to metallize wax molds or a variety of thermoplastic polymers such as vinyls, cellulosics, etc.

Master Model Materials

A great variety of mold materials have been successfully used for the construction of the master model. Low cost gypsum cement and resin-impregnated gypsum cement molds have proved to be very satisfactory materials. Plastic casting resins and low melting metal alloys can also be advantageously employed. Cast, machined, or carved hard metal molds are, of course, completely satisfactory for master models but involve high production costs. Hard metal molds can, however, be employed a greater number of times than any other master model construction materials.

Master models can also be produced from non-rigid materials. Certain rubber compositions and suitably formulated vinyl plastisols, for example, have proved to be satisfactory in master models, especially for spraying zinc, tin, etc.

It has been suggested that big savings could be realized by making the master itself by spray forming. A wax model of the desired object cannot, for example, be sprayed with steel because of the heat developed during the spraying operation. However, a plaster mold can be obtained from the wax model which in turn can be sprayed by a variety of metals including zinc, tin, Babbit, etc. "This form can also be sprayed with any hard metal such as steel to form the final mold. In cases where the original object exists already in wax, it is cheaper to utilize the spray forming process to produce the master than it would be to machine and carve the object in a solid piece of metal" (1)[1].

Making the Master

Conventional mold making equipment can of course be utilized for the production of hard metal master models. Lower melting metals can, in many cases, be shaped into molds with "homemade" facilities (2). Plastic casting resins and gypsum cement formulations require a small fraction of the investment in the necessary tools and shop equipment for the production of master models compared to hard metal mold manufacture (3, 4, 5).

The production of non-rigid masters from rubber formulations, vinyl plastisols, hot melts, etc., can be carried out with similarly simple shop equipment and tools.

That master mold making procedure which requires a minimum of machining time and hand labor on the master, and yet results in the production of models of suitable quality for the specific application under study, will often be found most economical for the manufacture of sprayed metal shell forms.

Reference has been made previously to the importance of proper master mold design. Equally important, of course, is proper workmanship in the making of the master model. It is absolutely necessary, for example, for all rigid masters that

[1] Numbers in parentheses refer to references appearing on p. 116.

all sections should have the proper taper and draft. Of course, no undercuts are permissible if re-use of the master is intended.

As sprayed metal will produce an extremely accurate reproduction of the master model, care should be taken to assure that the face of the master is in exactly the same condition as is desired of the sprayed metal form. A polished, smooth, and shiny sprayed metal shell, for example, requires a master model which is equally smooth and polished.

Preparation of the Master

Proper preparation of the master surface for metal spraying is essential in order to obtain a deposit strong enough to prevent warping or curling of the sprayed metal, but which can be removed from the master without damage to either shape. The specific techniques employed to assure a satisfactory preparation of the master surface vary with different mold materials and for various sprayed metals. A general rule which applies in all cases is that the surfaces onto which metal is to be deposited should be thoroughly dried prior to spraying.

Non-rigid master models need generally but little preparation of the surfaces onto which the metal is to be sprayed. A "clean" model, i.e. a surface free from all objectionable foreign matter, is the sole requirement for successful metal spraying. Suitable cleaning procedures have been worked out by the manufacturers of specific mold materials and usually can be obtained upon request without charge. A variety of sprayed metals including lead, zinc, tin, etc., have been successfully deposited in one series of experiments, for example, on such diverse master model materials as unplasticized and plasticized vinyls, Thiokol casting compounds, various rubber compositions, etc., without any special preparation of the master surfaces except cleanliness.

The preparation of rigid master surfaces for metal spraying, however, is more of a problem. The deposition of very thin films of certain mold release agents onto the master model has been found helpful in permitting the release of the sprayed metal form subsequent to the completion of the metal spraying step without promoting curling or warping of the metal. The most successful mold release agents were found to be a number of proprietary silicone compounds, which can be readily applied to the master either by spraying or wiping. Such treatment has proved to be particularly effective with masters which were composed of gypsum cements and similar materials. However, production of a continuous coherent sprayed metal deposit has been found to be somewhat of a problem in cases where either an excess of separating agent has been applied or where an extremely smooth master surface is encountered. A similar situation may arise for certain combinations of metal and master materials. In such cases the deposition of a very thin spray coat of tin or zinc on the master has been found to be helpful. Where a master is to be used repeatedly for the making of shells, blasting with extremely fine silica dust has been resorted to successfully—*not* in order to roughen the surfaces but to clean them (1). An extremely smooth but slightly matted finish produced the best results.

Mounting the Master

Mounting the master before spraying presents no special problems. The master should be rigid and have a base by which it may be held during the spraying operation. The mounting should also permit anchoring or tying down the edge of the sprayed metal to prevent curling and warping as well as lifting of the sprayed metal around the edges.

Suitable mounting devices can easily be designed for specific masters. A very simple method for tying down the edges of the sprayed metal consists of roughening the base plate around the edges of the master by grit blasting, sandpaper, etc. The use of a frame has been found to be convenient in many cases. Typical setups for both methods are shown in Fig. 1, p. 105.

Where the sprayed metal shell is to be backed up by casting it with gypsum cement or the like, a frame can be constituted in such a manner as to accommodate the backing material as well as the spray form.

Metal Spraying

Sprayed metal coatings are obtained by the use of an air blast which projects suitably heated metal particles against the object to be coated. The object is impinged upon by extremely small metal globules in the plastic state, which flatten out and interlock, thus forming a continuous though somewhat porous coating.

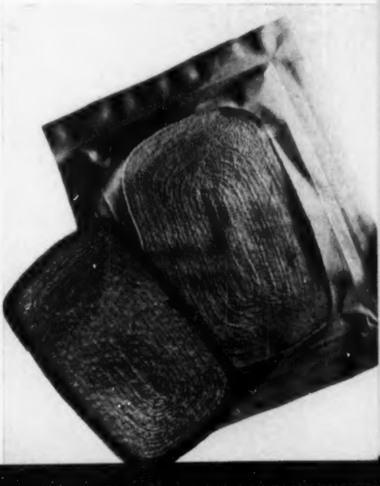
There are two processes for obtaining sprayed metal coatings, which may be classified as the wire gun and the powder methods. The first utilizes metal in the form of a wire which is fed, at a speed just sufficient to produce melting, into an acetylene or oxy-hydrogen flame, with a variable speed type air driven turbine. The powder method utilizes finely powdered metal, which is carried into the flame by means of suction.

It appears that the main applications of the powder method of producing sprayed coatings are other than the production of sprayed metal molds. Because of the cost of producing powdered metal, the process is not economical, except for the rare occasions where the deposition of special alloys is required which cannot be conveniently prepared in wire form. The subsequent discussion refers therefore primarily to wire guns, but applies equally, in general, to the powder process.

Only a modest amount of equipment is required to carry out metal spraying or metallizing operations successfully. The savings which can be realized by application of the metal spraying technique are in many cases sufficient to pay for the entire equipment costs within one year.

A complete metallizing installa-

Fig. 4—Cloth master and sprayed mold



tion (6) includes the following items: a) source of compressed air; b) source of fuel gas; c) air and gas control units; d) spray gun plus accessories (hose, etc.); e) ventilation equipment; f) metal dust recovery unit (optional).

Items a) to d) inclusive require no further explanation. Item f) is absolutely essential both in order to prevent respiratory hazards to the gun operator, and to guard against fires and explosions. The fumes of lead, lead alloys, bismuth, antimony, cadmium, etc., are especially dangerous. A metal dust recovery unit can easily be added to the ventilating equipment at nominal cost.

It is most convenient to spray the mounted master on either a rotating turntable or in a lathe, in order to obtain maximum coating uniformity. Turntables are often available in a spray booth. Inexpensive turntables can be readily built or purchased. Where large objects have to be handled, a turntable arrangement is less practical. In such cases, excellent results have been consistently obtained merely by exercising the proper care to cover all areas of the master uniformly. Guns should generally be held at a distance of from 6 to 8 in. during spraying.

Spraying conditions depend upon the metal to be sprayed and the construction and size of the equipment available. Typical fuel and air consumption data, etc., are given in Table I. These data were obtained with the Metco Type 4E gun which incorporates the latest technological developments in both design and construction, and is representative of the high grade metallizing equipment available today. This gun can be employed with all sizes and kinds of wire from 20 gage to ⅛ in. diameter. With ⅛ in. wire, speeds can be varied from 1.5 to 12 ft./min. Approximately 30 ft. of free air at 50 to 55 p.s.i. are required with this unit. The model 4E spraygun and a typical metal spraying installation are illustrated in Figs. 2 and 3. Both smaller and larger sized spray guns are readily available.

Given the surface area of the master which is to be sprayed, the data of Table I permit the calculation of the spraying time necessary to obtain a desired coating thickness for a number of commonly sprayed metals.

Fig. 5—Gypsum cement master models are easily duplicated with sprayed metal mold process

The estimation of metallizing costs for various spraying jobs is also made possible from data such as in Table I. The master's surface area must, of course, be known in order to carry out the necessary simple calculations. When estimating the surface area, an allowance must be made for the so-called edge loss. A suggested safe rule is the addition of 1 in. to each dimension where there is an edge, to compensate for the loss of metal. More precise calculations should take into account the variation in coating between the thickest and thinnest portions.

The selection of the metal to be sprayed has to be made on the basis of the physical properties which are desired for the sprayed form. The physical requirements of the latter should be carefully analyzed, because there is frequently a tendency to overrate them; i.e., to specify strength properties etc. which are not warranted by the mold's service conditions. Wherever possible, metals with low shrinkage should be selected, in order to produce optimum dimensional accuracy and avoid difficulties such as warpage. Metal inserts may be placed in the sprayed metal shell in order to strengthen certain sections of the mold, prevent warpage, form deep cut projections that could otherwise not be made readily, etc.

Removing the Sprayed Shell

Where sprayed shells are to be backed up by casting metal, etc., it has been found more satisfactory to defer the stripping operation until such time as the backing process has been carried out. This consideration does not apply where the backing is to be made of nonmetallic materials, such as gypsum cements or plastic casting compositions. The use of a non-rigid master, of course, eliminates all shell stripping problems.

All excess sprayed metal should be carefully removed before commencing the stripping operation. Where the master surface has been coated with a suitable mold release agent, the sprayed metal shell can often be separated quite easily from the master. Tapping the shell with a mallet has been found to facilitate the stripping operation. A thin knife can be inserted carefully between the shell and the master and then moved all along its edge to help force

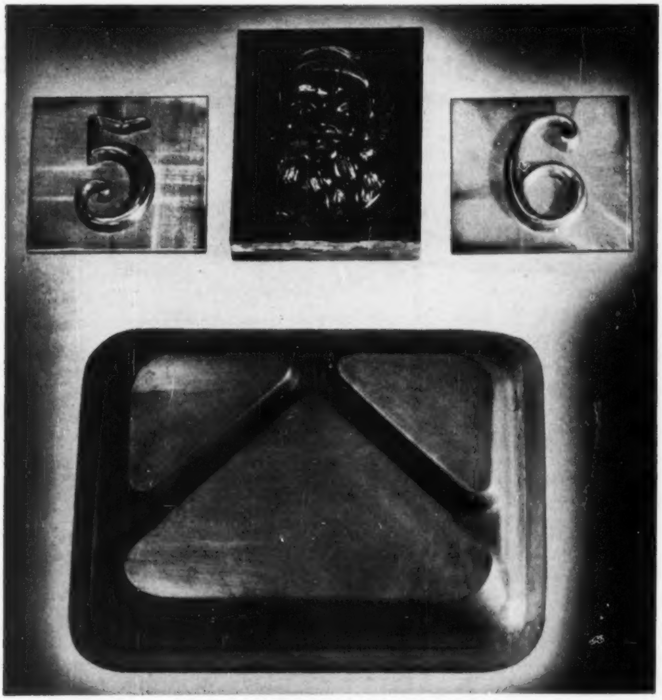


Fig. 6—Metal will be directly sprayed on gypsum cement male masters to form the molds

prime requirement for the production of a backing, although more elaborate setups have been found necessary in certain specialized applications.

Gypsum cements and similar products have been found to be very satisfactory backing materials in applications where great mold strengths are not required (1, 4). They are easy to handle and require but little shop and tool equipment. Very intricate shapes can be filled without difficulty, and with great accuracy, because of the small dimensional changes occurring upon setting.

Where somewhat greater physical strengths are required than can be attained with gypsum cements, the use of resin impregnated gypsum cements or resin-gypsum casting slurries is indicated. The simple equipment of the plaster casting shop can also be successfully utilized for the production of such backings (8).

A variety of plastic casting compositions are commercially available which can be cured at room and/or slightly elevated temperatures.

(*Continued on page* 112)

the two shapes apart. If a knife is used, it is very important to work slowly in order to avoid damage, especially with a soft metal shell.

The removal of hard metal shells from hard metal masters which were given an extremely thin coating of tin or other low melting metal before the spraying process, can be carried out by heating the assembly to above the melting point of the tin coating. The success of this stripping procedure depends on the careful removal of all excess metal around the edges of the master, etc., for obvious reasons.

Backing Up

Although spray formed metal shells can be employed "as is" in some applications, a backing is indicated for the majority of the uses which have been developed or proposed for these low cost metal molds. Depending upon the service requirements of the assembly, a variety of backing materials have been successfully utilized. The construction of a suitable tight fitting frame around the shell is generally the

Fig. 7—Sprayed metal shell molds from plaster models retain fine details of originals

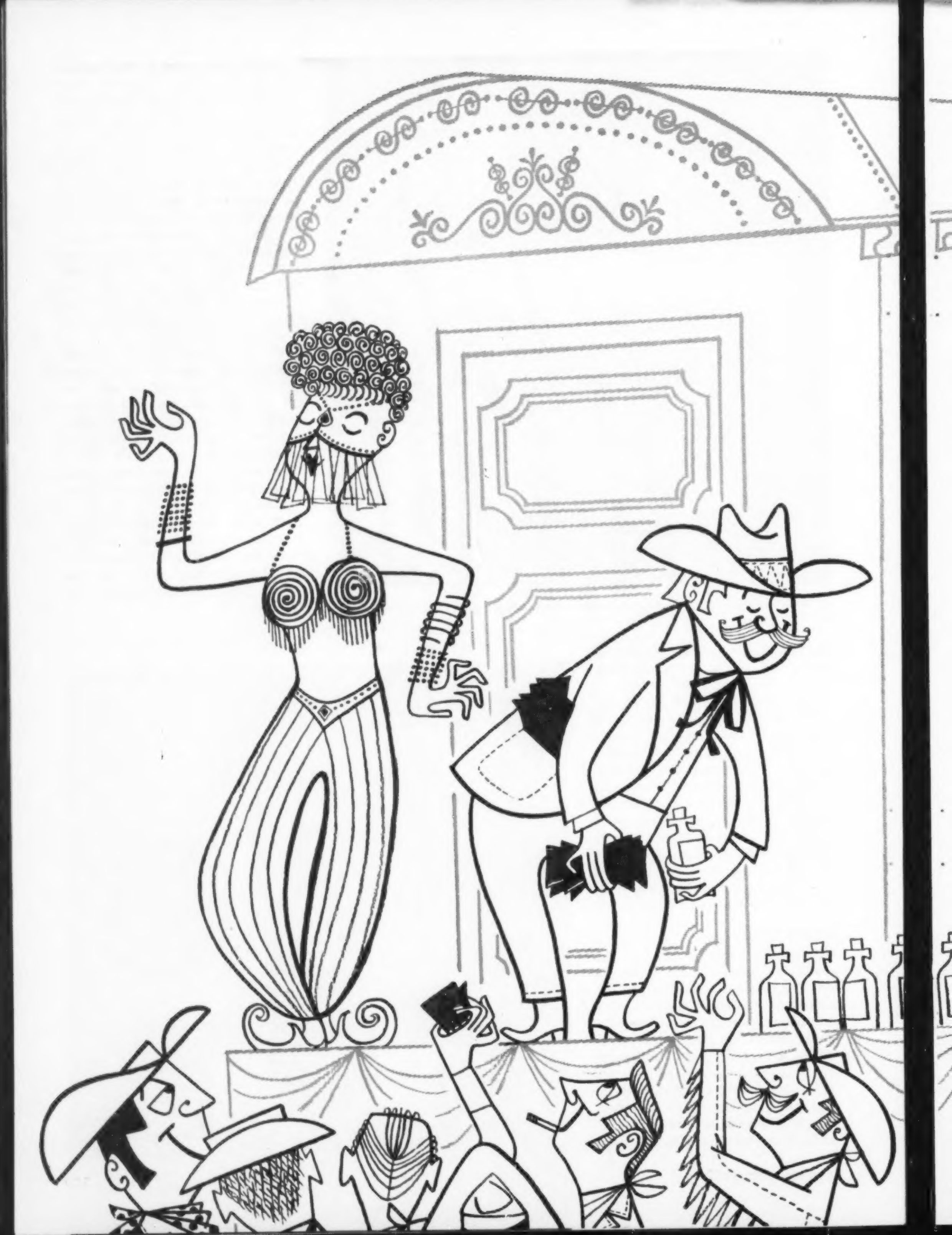


Table I—Typical Metal Spraying Data for Metco Type 4E Gun*

Metal and wire size (in inches or B&S gage)	Operating pressures, p.s.i.			Consumption per hr.			Sq. ft. covered/hour, 0.001 in. thick	Approx. costs[3]			Deposition effi'cy
	Air	Oxygen	Acetylene	Metal	Oxygen	Acetylene		Total cost/hour	Cost/lb. sprayed	Cost/sq. ft., 0.001 in. thick	
				lb.	cu. ft.	cu. ft.		$	$	$	%
Aluminum, ⅛ in.	55	32	32	9.2	66	32	676.8	7.47	0.81	0.011	92
Aluminum, 15 gage	55	15	15	2.1	21	13	149.6	3.62	1.72	0.024	89
Copper, ⅛ in.	55	32	32	17.1	66	32	349.0	10.11	0.59	0.029	80
Copper, 15 gage	55	20	20	5.3	33	19	111.0	4.94	0.93	0.045	82
Nickel, ⅛ in.	55	32	31	11.2	66	30	225.2	15.63	1.40	0.069	79
Metcoloy No. 1, ⅛ in.[1]	55	31	31	12.0	63	30	270.0	11.30	0.94	0.042	81
Sprasteel 10, ⅛ in.[2]	55	34	29	11.9	73	28	301.7	5.88	0.49	0.019	88
Tin, ⅛ in.	55	21	21	28.2	30	16	598.5	56.41	2.00	0.094	73
Zinc, ⅛ in.	55	28	28	27.0	50	26	530.2	13.75	0.51	0.026	65

* Manufactured by Metallizing Engineering Co., Long Island City 1, New York.
[1] 18-8 very low carbon type stainless steel.
[2] 0.10 carbon steel.
[3] Cost data are based on a recent survey; they do not include overhead and other indirect costs; the figures were obtained using the following prices: acetylene $2.75/100 cu. ft.; oxygen $1.20/100 cu. ft.; air $0.01/100 cu. ft.; labor $1.50 per hour with 80% utilization.

Very satisfactory backings have been realized with such resinous casting materials. Attention should be given to the chemical nature as well as the shrinkage characteristics in the selection of these casting compositions, in order to avoid not only a poor bond but also chemical attack of the resin on the sprayed metal shell.

Low melting non-shrink metal alloys may be cast onto the back of sprayed metal shells to produce very satisfactory molds where the assemblies are to be employed cold or at low temperatures only (2). Other metals such as zinc, aluminum, etc., are not suitable for gravity casting because these metals will shrink on cooling and tend to separate from the shell form. Pressure casting methods have been found more satisfactory, especially for the high melting point alloys.

Sprayed metals themselves may be utilized to produce shell backings (1). Zinc has been found to be one of the most satisfactory materials, on account of its low shrinkage and superior ductility even in the sprayed form. Zinc also has the desirable features of low cost and easy machinability.

A very recent development has resulted in the use of polyester-fibrous glass laminates for backing sprayed metal shells. Both contact and low pressure laminates have been successfully employed for a variety of sprayed metal forms in applications requiring considerable strength for the complete assembly. Typical of the uses to which such metallized low pressure laminate plastic molds have been put are the production of aircraft radomes, small boats, etc.

Mounting Spray Formed Shells

Consideration of the mounting requirements of the spray formed shells prior to production pays off, because frequently the master and the mounting frame for the metal spraying operations can be designed and constructed in such a manner as to obviate the need of building any additional mountings later. Shell molds which are to be used with platens should be flat on the back and the platen upon which they rest should also be flat. A tight fit is desirable in order to take advantage of platen strength. Care should be taken in the design of mountings to take into account the essential physical properties of sprayed metals, i.e. strength in compression, lack of tensile strength, tendency towards brittleness, etc.

Applications for Molds

Although the principal applications of sprayed metal shell molds can be found today in the production of low pressure molds, recent developments in metallizing techniques and better backing materials suggest that improved spray forms may soon be suitable in uses where higher pressure and more stringent service requirements are demanded, such as, for example, in the injection molding of plastics. The combination of sprayed metal shells with polyester-fibrous glass laminates offers unusual possibilities to alert mold designers.

One of the most rapidly expanding applications for sprayed metal shells is the production of molds for sheet forming operations. Thermoplastic sheet materials can be readily formed or drawn into a great variety of shapes by the application of heat and a moderate pressure differential, which can be attained with vacuum, air pressure, or a combination of both, as well as other means. Acrylic sheets, rigid and plasticized vinyls, vinyl plastisol sheeting, cellulose acetate, cellulose acetate butyrate, cellulose nitrate, ethyl cellulose, polystyrene, styrene copolymers, polyethylene, etc., have all been satisfactorily formed. The products which have been mass produced by sheet molding techniques range from masks and place mats to trays, three-dimensional advertising displays, and terrain relief maps.

The excellent reproduction of master model detail in sprayed metal shell forms makes possible the production of place mats with intricate designs simulating cloth products, etc. That high quality sprayed metal shell molds can be obtained directly by spraying onto a cloth master is shown in Fig. 4, which depicts both the original cloth and the sprayed metal form which was produced from it. Plastic place mats can be drawn against suitably backed sprayed metal molds in forming cycles of as little as 6 sec. with newly engineered sheet molding equipment.

The manufacture of plastic tote boxes is an interesting example of

the utility of sprayed metal molds in low pressure sheet forming operations. The pattern to be duplicated may be wooden or gypsum cement. In either case it is first sealed by a suitable lacquer and then coated with a thin uniform film of a parting agent. Next, a low melting metal alloy is sprayed onto the matrix to give a deposit approximately ⅛ in. thick. This may be followed by a second spray coat of a harder alloy such as bronze. A total sprayed metal thickness of ¼ in. is often sufficient to meet the requirements of the job. The sprayed metal mold is then stripped from the matrix and backed up with one of any number of materials.

The construction of a suitable frame around the matrix permits the backing operation to be carried out in place before the shell mold is stripped. Where vacuum holes are required, common pins or something similar may be inserted into the pattern before spraying and removed later.

Intricate Designs

Such sprayed metal molds can easily reproduce intricate designs, very fine surface finishes, etc. Their better thermal conductivity compared to wood or plaster patterns facilitates the earlier removal of the formed plastic sheet stock, thus increasing productivity by cutting cycle times. Durability—i.e. the number of impressions obtained with a given mold—compares favorably with wooden or plaster molds.

A considerable number of companies have taken advantage of the excellent properties of sprayed metal molds in low pressure forming work. Among them are such names as Noma Electric Co., New York, N.Y.; Auburn Button Works Inc., Auburn, N.Y.; Lancaster Moulded Plastics Corp., Lancaster, Mass.; American Merri-Lei Corp., Brooklyn, N.Y.; and Induction Heating Corp., Brooklyn, N.Y.

Fig. 8—Slush casting (right) and mold

Gypsum cement models can be easily and accurately duplicated with the sprayed metal shell form process. A few gypsum cement casts are shown in Figs. 5 and 6. Typical of the sprayed metal shell molds which were obtained by directly spraying the plaster casts are depicted in Fig. 7. A Babbit-type alloy was used to form the spray metal molds. These molds were made for the Industrial Radiant Heat Corp., New York, N.Y.

Slush Casting Molds

Slush casting affords another excellent example of the versatility of sprayed metal shell molds. Fig. 8 shows the outside of a hollow sprayed metal shell mold and the vinyl plastisol doll's head which was produced by slush casting *inside* the hollow mold. The manufacture of this one-piece slush mold can be carried out by the metal spraying techniques in the following manner:

The master pattern consists of a butyrate doll head approximately 8 in. high. It was throughly cleaned to rid it of any oil, grease, grit, or other contaminants. A lead-tin alloy was then sprayed onto the head until a metal build-up of 0.040 in. was obtained. A 0.125 in. bronze spray coating was next deposited over the initial metal layer. Approximately 1½ ft. of lead-tin alloy and 5 ft. of bronze wire were employed for the spraying process. Care was taken to limit the temperature rise of the butyrate pattern in order to prevent thermal distortion of the matrix. This was accomplished by stopping the spraying operation about once every 4 min., at which time a brief blast of compressed air was applied to the work. The matrix could be kept cool quite successfully by consistently following this simple spraying technique.

The metal coated head was then placed in an oven in order to melt the butyrate out of the sprayed metal shell. After this had been accomplished, the mold was vaporblasted. This was done in order to remove the high luster from the interior of the sprayed metal mold, which was not desirable for this particular application. While the entire mold production process required about 1 hr., the metal spraying operation, including cooling periods, took only approximately 35 minutes.

Utilization of sprayed metal molds in slush castings has been made by numerous companies. Both costs and production time requirements of sprayed metal molds compare favorably with electro-formed shells for this application.

One of the most important applications for the spray forming process is the production of duplicator master molds for use on duplicating machines such as the Gorton. Hard steel faced master metal spray forms produce a large saving by cutting the hand tracing time several hundred percent, because steel molds permit the use of styluses and cutters which would damage gypsum cement casts.

The aircraft industry has adopted the sprayed metal mold forming process for the manufacture of a variety of jigs, fixtures, etc. A recently published paper describes the use of both gypsum cement and plastic matrices for the production of molds to make certain complex aircraft shapes (Fig. 9), radomes, etc. (4). A more recent related development has resulted in the utilization of alternate sprayed metal-polyester-fibrous glass laminate layers in the making of molds for low pressure molding of reinforced plastics. Typical of this type of work is the manufacture of a mold for the production of reinforced plastic wingtips.

The desired wingtip had an overall area of approximately 15 square feet. A thoroughly dry and clean gypsum cement form was employed as the primary pattern. The surface of this shape was first sealed with two coats of cellulosic type lacquer. A very thin though uniform film of a suitable parting agent was then deposited over the wingtip area.

A lead-tin alloy wire was sprayed over the entire matrix surface to a thickness of 0.040 to 0.125 in., care being taken to carry the spray beyond the edges in order to lock the deposit in place. A $\frac{3}{16}$ in. thick deposit of a bronze alloy was next built up. Suitably cut fibrous glass cloth was draped over the sprayed metal deposit and impregnated with a properly catalyzed liquid polyester

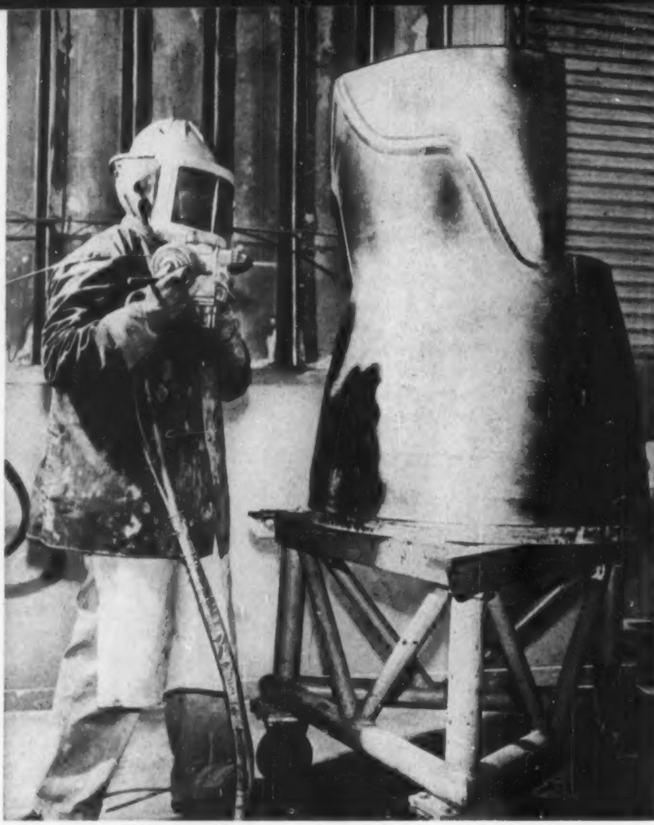


Fig. 9—Gypsum matrix is sprayed with metal to produce mold for complex aircraft shapes

resin. Type ECC 128 fibrous glass cloth (Owens-Corning Fiberglas Corp., New York, N.Y.) was employed for this particular job. The thickness of the cloth amounts to 0.007 inch. A 0.004 in. thick layer of the bronze alloy was then sprayed over the resin-impregnated cloth. Alternate layers of resin impregnated fibrous glass cloth and bronze were now deposited until 10 to 12 layers of fibrous glass had been used to obtain the desired mold thickness.

The sprayed metal-fibrous glass reinforced polyester mold was then stripped by cutting to the desired trim line and lifting from the matrix. The metal mold face was polished and coated with a suitable separator. In order to ready it for use for repeated fibrous glass-polyester layups of the wing tip, it was mounted in a simple frame.

Applications of sprayed metal molds for the production of low pressure laminates as well as aircraft jigs and fixtures, etc., have been greatly furthered by the favorable results which such prominent manufacturers as Douglas Aircraft Co. Inc., Santa Monica, Calif.; North American Aviation Inc., Inglewood, Calif.; Zenith Plastics Co., Gardena, Calif.; and Lunn Laminates, Inc., Glen Cove, N.Y.; have consistently obtained from their use.

Plastics Casting Molds

An application which is of equal interest to the plastics industry involves the production of sprayed metal shell molds for the casting plastic materials such as phenolics, etc. Such shells require but little strength and can therefore be backed up with gypsum cements, etc. The process lends itself especially to the manufacture of molds with intricate shapes of both the single and multiple cavity type. Where castings have to be heated to accomplish curing, care should be taken to select a metal which can withstand the curing temperatures.

Attempts have been made to utilize sprayed metal shell molds for plastic injection molding and rubber molding. The selection of a backing of material is of considerable importance for such uses, because considerable strength is desired for the shell molds. Thus far only sprayed metal molds of limited size have been subjected to moderate pressures in this kind of application but, as indicated above, improved spraying and backing techniques may greatly enlarge their utility.

Other interesting applications of sprayed metal molds include the production of paint masks, molds for wax molding, mock-up work, etc. These and the many uses to which sprayed metal shells have already been successfully put suggest that other types of molds and dies which are being produced by other mold forming techniques can be manufactured with this low cost technique.

Acknowledgements

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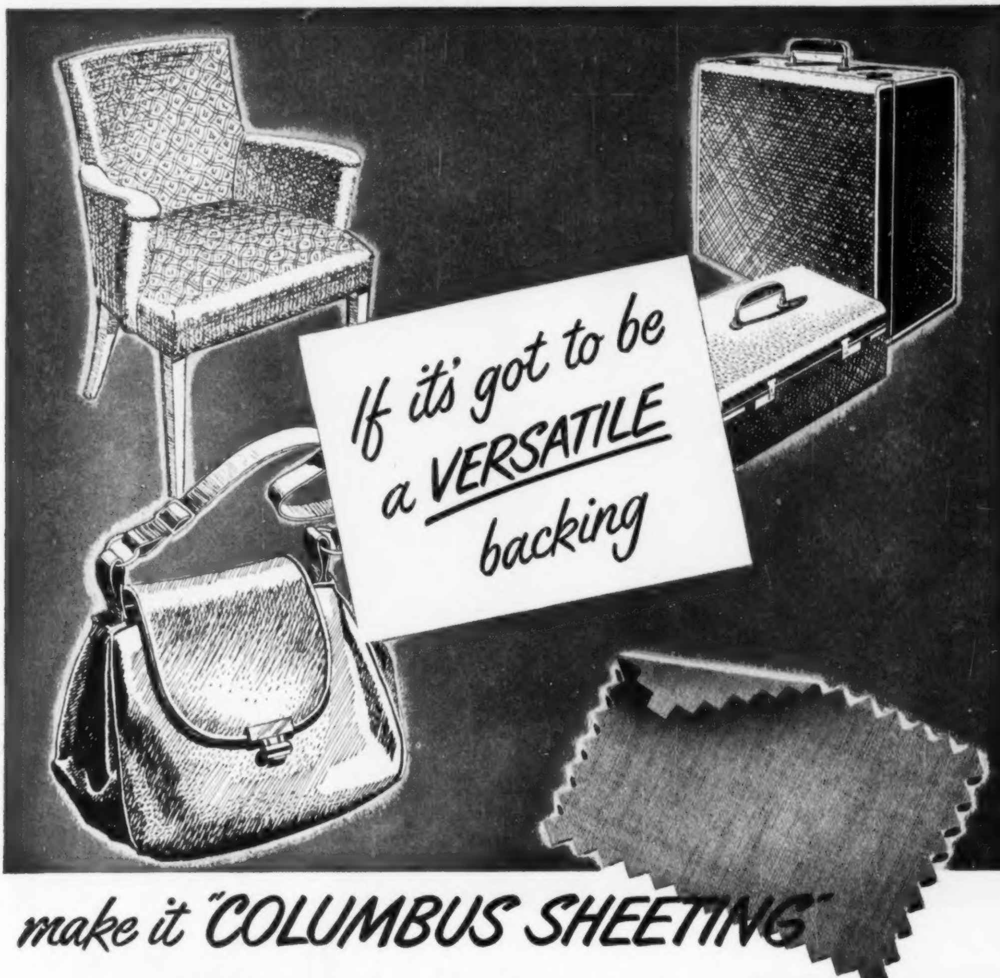
If it's got to be
a VERSATILE
backing

Effect of Moisture and Fungus on Plastic Insulating Materials

by R. K. WITT,† J. J. CHAPMAN,†† and B. L. RASKIN†††

FUNGUS-coated plastic parts on communication and optical equipment were the cause of many complaints from the Armed Forces in the hot, humid south Pacific areas during World War II. What caused their equipment failures? Was it the moisture, the fungus, or both? What kind of fungus was most detrimental? What type of plastic was most easily ruined? Field data were inadequate and difficult to analyze.

To obtain the answers to these questions the mechanical and electrical properties of 28 plastic insulating materials including nine laminates, nine molded thermosets, and ten rigid thermoplastics were investigated in the Plastics Laboratory of the Johns Hopkins University. The samples were exposed to 85%, 95%, and approximately 100% relative humidity for a period up to 6 months. Two simultaneous series of test were run; one in an atmosphere of nitrogen, which it was hoped would inhibit fungus growth, and the other in an atmosphere of air and penicillium luteum SN-41 spores, to encourage growth of the fungus.

The following mechanical and electrical tests were made:

Izod impact edgewise: laminates only.

Izod impact flatwise: all materials except 28 and 33.

Flexure edgewise: laminates only.

Flexure flatwise: all materials except 28 and 33.

Dissipation factor at 1 k.c., 1 m.c., and 30 m.c.: all materials

Dielectric constant at 1 k.c., 1 m.c., and 30 m.c.: all materials.

Arc resistance: all materials.

Dielectric strength perpendicular: all materials.

Dielectric strength parallel: all materials.

Surface resistance: all materials.

Volume resistance: all materials.

Joint Army-Navy, Federal, or A.S.T.M. specifications were the source of most of the test methods; however, considerable freedom was allowed in setting up the tests in order to be able to operate under the unusual sample conditions.

Because this project was carried out with the understanding that manufacturers' names would not be made public, a Johns Hopkins code number was assigned to each material (Table I). These designations are used in all the graphs.

Fungi, like any other parasites

† Associate Professor of Chemical Engineering, Johns Hopkins University
†† Research Associate, Johns Hopkins University, Institute for Cooperative Research
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Table 1—Plastics Investigated at Johns Hopkins

Johns Hopkins designations	*Joint Army-Navy type*	*Description*
		LAMINATED THERMOSETTING PLASTICS
1	LTS-M4(FBM)	A canvas-base material; good mechanically, poor electrically; grows fungus readily.
2	LTS-E2(PBG)	A paper-base material; used for general electrical applications.
3	LTS-E2(PBG)	Same type as material 2, but made by a different manufacturer.
5	LTS-E5(PBE)	A kraft paper-base material with high frequency applications; punching stock.
7	LTS-E5(PBE)	Same type as material 5, but made by a different manufacturer.
9	LTS-E6(GBE)	A glass-cloth phenolic material with good electrical properties.
10	LTS-MH1	An asbestos-cloth material with mechanical and heat-resistant properties predominant; good dimensional stability.
11	LTS-GMG	A glass-cloth melamine material with excellent arc resistance; general purpose.
12	LTS-EM1(FBG)	A fine-cotton-fabric phenolic material with mechanical and electrical properties predominant; easy to machine.

(Continued on p. 120)

Table 1—Plastics Investigated at Johns Hopkins (Continued)

Johns Hopkins designations	*Joint Army-Navy type*	*Description*
		MOLDED THERMOSETTING PLASTICS
13	MTS-M4(CFI-20)	A phenolic cotton-flock material used where high impact strength is desired; mechanical properties predominant.
14	MTS-MH2(MFI)	An asbestos-filled phenolic material with heat-resistant properties predominant.
15	MTS-E1(CFG)	A cellulose-filled phenolic material with electrical properties predominant; general purpose.
16	MTS-E1(CFG)	Same type as material 15, but made by a different manufacturer.
17	MTS-E1(CFG)	Same type as materials 15 and 16, but made by a different manufacturer.
18	MTS-E4(MFE)	A mica-filled phenolic material with electrical properties predominant; has low dielectric loss.
19	MTS-E4(MFE)	Same type as material 18, but made by a different manufacturer.
20	MTS-E4(MFE)	Same type as material 18 and 19, but made by a different manufacturer.
21	MTS-G2	A cellulose-filled melamine material of general usage; has good arc and flame resistance.
		RIGID THERMOPLASTICS
24	RTP-OH-1	A cellulose acetate material with good optical properties, a high degree of heat resistance, but not recommended in general for structural parts.
25	RTP-EM1	An ethyl cellulose material with good dielectric strength and impact strength; relatively low electrical losses and may be used for radio frequency applications; tough, strong, has excellent low temperature shock resistance, alkali resistance, and dimensional stability.
26	RTP-EM2	A vinylidene chloride material with general purpose applications, resistant to practically all inorganic solvents and completely resistant to water; not suitable for uses involving resistance to high speed impact, shock resistance, or flexibility at sub-freezing temperatures.
27	RTP-EM3	A nylon material with very good mechanical properties; extremely tough and form-stable at high temperatures; radio frequency applications.
28	RTP-EM4	A vinyl chloride acetate material with chemical inertness, dimensional stability, resistant to water and most chemicals; easily fabricated, but has a relatively low heat resistance.
29	RTP-OS-2	A methyl methacrylate material with excellent optical properties; suitable for radio frequency applications but not recommended in general for structural parts.
30	RTP-E2	A polystyrene material with good optical properties; very good electrical properties which remain practically constant over a wide range of frequencies, temperatures, and humidities and are not impaired after long immersion in water; excellent moldability, dimensional stability, and stability at low temperatures.
31	RTP-E2	Same type as material 30, but made by a different manufacturer.
32	RTP-E2	Same type as materials 30 and 31, but made by a different manufacturer.
33	RTP-EH1	A styramic material with a very high heat resistance obtained at a slight sacrifice in toughness; similar in application to polystyrene.

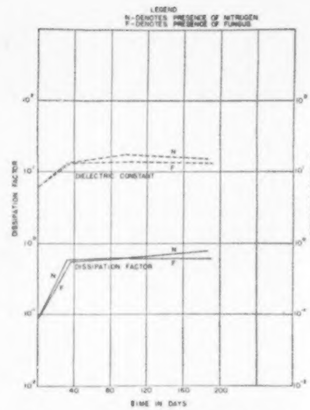


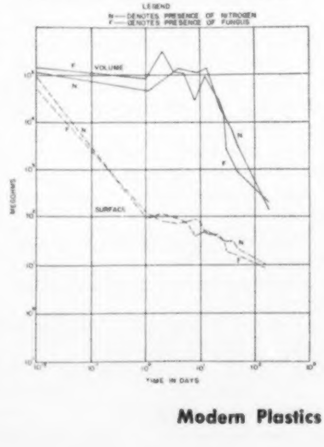
Fig. 1—Dielectric constant and dissipation factor at 1 m.c. of material No. 1 at 25° C., 100% relative humidity

need food; since the specimens were cleaned, it was assumed that if fungus was found to have grown on a plastic, the plastic and not dirt or any other contaminant furnished the food. The technique used to clean the plastics was one which did not remove or inhibit the growth of fungi on the specimens. No measurements were performed on test specimens that were definitely known to be free from fungus growth, since no microbiological examinations were made. It must be remembered, however, that under practical conditions surfaces are often contaminated which results in even more copious growth.

Results of Tests

Since approximately 27,300 specimens were tested giving about 46,

Fig. 2—Surface and volume resistance of material No. 5 at 25° C., 100% R.H.



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500 property values, it is impossible to give the detailed results in this article, but the graphs and conclusions should be of value to the users of plastics. In order to avoid cumbersome lists of data and numerous charts, bar graphs were used to illustrate the 6-months' deterioration of all materials for each of the salient properties. The property values of the individual members of each of the three material groups for the dielectric strength perpendicular, surface resistance, volume resistance, and flatwise flexure tests are arranged in order of the increasing values of their first points of deterioration and the arc resistance, dissipation factor, dielectric constant, and flatwise Izod impact tests are plotted according to their increasing initial property values. This should afford a quick means of selection of materials for specific uses in which moisture is an important factor.

Although moisture is conducive to fungus growth, the presence of the moisture itself was found to have been so significant that it overshadowed any effects that fungus may have produced. Although damage due to fungus growth may ultimately prove to be severe, the material, especially if it is of an electrical grade, will have lost its effectiveness due to the high moisture content in the atmosphere, long before deterioration due to the fungus attack has become apparent.

Fig. 1 (page 120) of the dissipation factor and dielectric constant at 1 m.c. of material 1 illustrates the importance of moisture. Although this plastic was found to support fungus growth more readily than any of the 27 other materials tested, it can be seen that over a period of 6 mo. the dissipation factor and the dielectric constant at 1 m.c. were not distinctively affected by the copious growth.

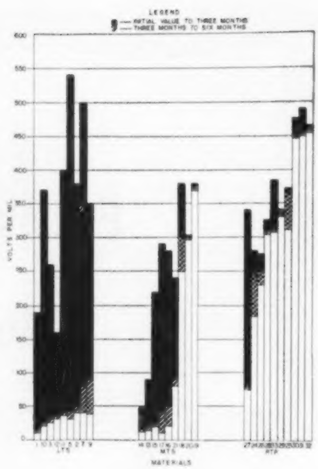


Fig. 5 (above)—Dielectric strength perpendicular test results on all materials. Fig. 6 (below)—Results of arc resistance tests made on all specimens. All tests were conducted at 25° C. and 100% relative humidity

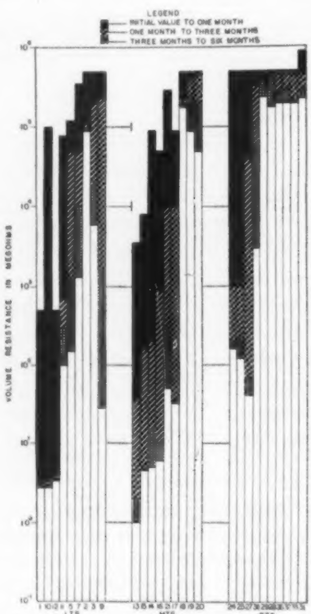
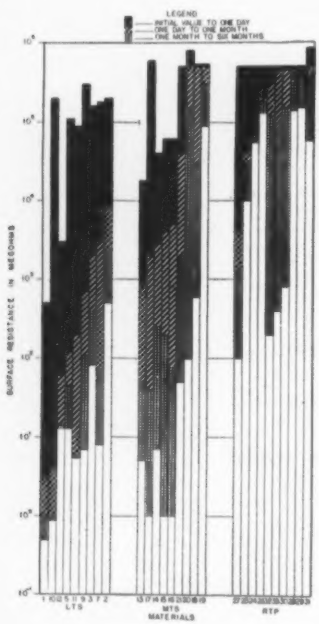
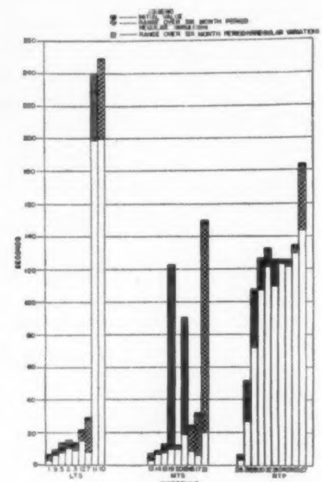


Fig. 3 (left)—Surface resistance of test specimens; Fig. 4 (above)—Volume resistance. Conditions of test: 25° C. and 100% relative humidity





Using the new type of surface and volume resistance measurement method,[1] it was possible to enclose samples of the plastic in humid, fungus-laden atmospheres and to compare their values periodically with those of similar samples enclosed in an inert atmosphere. Unlike the other tests, the surface and volume cell served as the conditioning chamber and therefore it was possible to take repeated measurements from one set of samples without disturbing them. With short-time data, it was possible to note the changes which took place immediately after the painted discs[2] were (*Continued on p. 202*)

[1] R. K. Witt, J. J. Chapman, B. L. Raskin, *Measuring of Surface and Volume Resistance of Plastics*, MODERN PLASTICS 24, 151 (April 1947).

[2] A silver conducting paint which allows free moisture penetration to the plastic was used to provide low resistance, firmly adhering electrodes.

Measurement of Heating Capacities of Injection Molding Machines

by C. E. BEYER† and R. B. DAHL†

A method of measuring and comparing the heating capacities of injection molding machines is described. This information is needed in order to set up a standard rating procedure for such machines. The method presented has several distinct advantages: 1) The temperature measuring device is relatively inexpensive and provides an accurate measurement of the average polymer temperature; 2) the results are independent of the control temperature and may be used for any temperature desired; 3) machines of different sizes and designs can be compared on an equal basis as to their heating ability; 4) the production rate for different materials can be simply computed from their thermal properties.

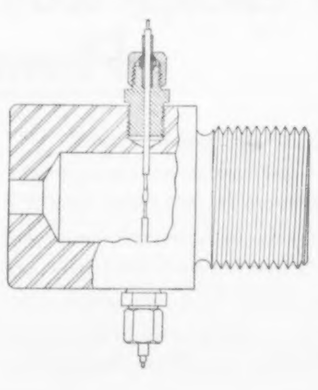
THE heating capacity of an injection molding machine has been rather loosely defined as the number of lb. per hr. of molten material that a machine will produce. The various machine manufacturers have no standard procedure for determining heating capacities and yet they list maximum output rates for their machines. This heating capacity figure is usually qualified by the phrase, "dependent on mold construction and molding material," or some similar statement. In this article it is demonstrated how the plasticizing rate depends upon the mold construction and molding material.

The early injection molding machines were originally patterned after the die casting machines. Early in the development of molding machines it was realized that, because the thermal properties of plastics are radically different from those of metals, the heating surface to volume ratio must be greatly increased in order to injection mold plastics successfully. In 1934 the Gastrow heating chamber was introduced in the United States. This device contained a spreader or torpedo within the heating tube which forced the plastic granules into a thin layer between the torpedo and the cylinder wall. Even with present day advances to larger capacity machines, the general design of the heating chamber remains essentially the same. Probably because of the lack of a suitable method of measuring the polymer temperature, the heating chamber design has been taken for granted.

Temperature Measurement

In any attempt to determine the heating capacity of injection molding machines the first consideration must be a method of measuring the temperature of the polymer as it leaves the heating chamber. In the development of a temperature measuring device the following considerations must be kept in mind: 1) It must be simply and conveniently attached to the molding machine; 2) it must be relatively inexpensive and easily constructed; 3) it must give an accurate temperature measurement of the polymer; 4) it must not provide excessive obstruction to the flow of polymer; and 5) it must be rugged enough in construction to withstand the large forces exerted by the flowing polymer.

Fig. 1—String thermocouple nozzle



The simplest place to incorporate the temperature measuring device is in the nozzle. Then by simply replacing the conventional nozzle by the temperature measuring nozzle the polymer temperature can be recorded. Several methods of placing a thermocouple in the nozzle were tried. Only one of the methods met all of the above requirements. A thermocouple wire was strung across the polymer stream and anchored to the nozzle wall as shown in Fig. 1. This string thermocouple nozzle can be constructed easily, or a conventional nozzle can be changed to hold a string thermocouple. The cost of a string thermocouple nozzle is small and the greatest expense would be in the temperature indicator or recorder used with it.

The string thermocouple as shown in Fig. 1 consists of a No. 20 gage, asbestos-covered, iron-constantan, butt-welded thermocouple. The thermocouple is coated with D.C. No. 993 varnish[1] and baked in an oven for 16 hr. at 250° F. The portion of the thermocouple that comes in contact with the metal is also covered with a 1/16-in. diameter silicone saturated glass fiber sleeving[1] as further protection against shorting of the wire to the nozzle. The thermocouple is placed across the center of the polymer stream with the junction located at a specific distance from the center of the polymer stream. The thermocouple is held firmly in place by using a 1/8 in. compression fitting.

A well-type thermocouple consisting of an iron-constantan couple

† The Dow Chemical Co.

[1] Both the varnish and sleeving available from The Dow Corning Corp.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protected by a ⅛ in. stainless steel tube was also tried. With this thermocouple it was difficult to determine the polymer temperature. Apparently, as the polymer flows past the junction some frictional heat is developed, because there is a sharp rise in temperature. This heat source, together with the heat conducted along the tube wall, and perhaps at times heat conducted in the opposite direction from the polymer, produces a cyclic transient condition at the junction. The polymer temperature is only one variable which is not easily separated from the other two.

The much smaller size of the string thermocouple wire greatly reduces the obstruction to the polymer flow. The varnish coating further reduces the frictional heat, with negligible effect on the temperature reading. The insulating material separating the thermocouple wire from the nozzle reduces the heat conduction to and from the thermocouple wire. The No. 20 gage wire has sufficient strength to withstand the polymer flow under normal molding conditions. It is recommended that a stronger wire be used if the control temperature is to be set much less than 400° F. for polystyrene.

Since the temperature of the polymer as it flows through the nozzle will vary as much as 100 degrees F., the point at which the temperature is measured must be accurately fixed. This is a simple matter with the string thermocouple and can be accomplished by shifting the thermocouple wire in the fittings or rotating the nozzle. Because of these large variations in temperatures, a method of measuring the average polymer temperature was devised.

The temperature of the polymer was measured at several points across the cross-section of the stream. These temperatures were weighted by the amount of material flowing past the point and a mass average temperature calculated. It was then found that the temperature recorded when the junction is placed 0.6 of the radius from the center of the polymer stream is within 3% of the average polymer temperature. When the nozzle was rotated and the temperature recorded at several positions it was noted that obstructions to the flow of polymer through the heating chamber produce temperature variations as large as 20 degrees F. Therefore a position must be found that will give an average temperature of the polymer. This position of the nozzle that will give the average temperature can be found by rotating the nozzle to several positions and then setting the nozzle in the position that will give a temperature equal to the average of the measured temperatures at the different positions. Since this temperature distribution will vary with different machines and positions of the torpedo, the position of the thermocouple that will give the average temperature must be determined for each machine. Thus far, the position of the thermocouple junction from the center of the stream has been found to be the same on all machines tested.

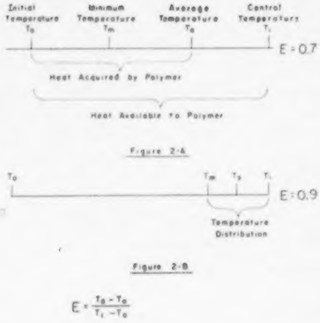


Figure 2

Heating Efficiency

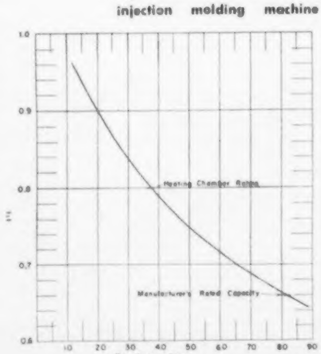
With a reliable method of measuring the average temperature of the polymer established, the next consideration is to find a method of relating this average temperature to the heating capacity of an injection molding machine. In the injection molding process the molding material at some initial temperature (T_0) is pushed into the heating chamber. In the calculations to follow, room temperature was used, but at times the temperature of the material in the hopper may be higher. If the molding material could stay in the heating chamber an indefinitely long time, all of the material would finally come to the control temperature (T_i). Since production demands that the material stay in the heating chamber for only a short time, some of the material does not reach the control temperature. Hence there is a range of polymer temperatures in the material leaving the heating chamber, with a resultant average temperature (T_a) somewhat less than the control temperature.

In Fig. 2 the length $T_i - T_0$ is proportional to the maximum amount of heat that could be acquired by the polymer, and the length $T_a - T_0$ is proportional to the actual amount of heat acquired by the polymer. The ratio of these two lengths can be defined as an efficiency of heating the polymer. Figures 2a and 2b show that the smaller the temperature variation the higher will be the value of the hearing efficiency. To obtain a higher heating efficiency the material must remain in the heating chamber longer, with a resulting lower production rate. There are times when this narrower temperature distribution is desirable, for example, in thin sections of higher-than-average quality moldings. It should also be noted that since this heating efficiency contains the ratio of polymer temperature to control temperature, it is independent of the control temperature. Thus, heating efficiency figures do not require a qualifying control temperature, but may be used at any temperature.

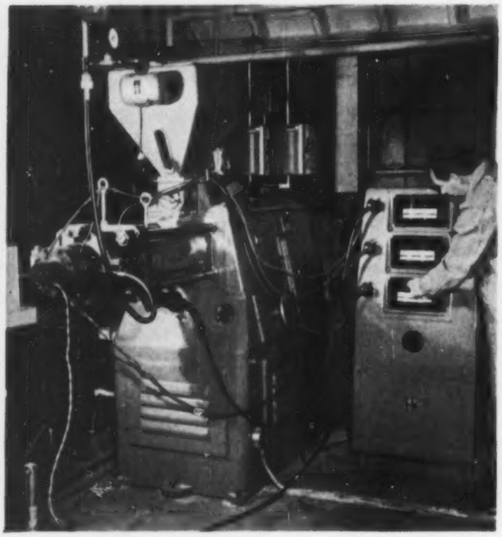
When the heating efficiency is plotted graphically against the production rate in lb. per hr. the relationship of output to temperature distribution is known. Figure 3 is a typical heating curve for an injection molding machine. This curve was obtained by purging the polymer through the string thermo-

(*Continued on p. 130*)

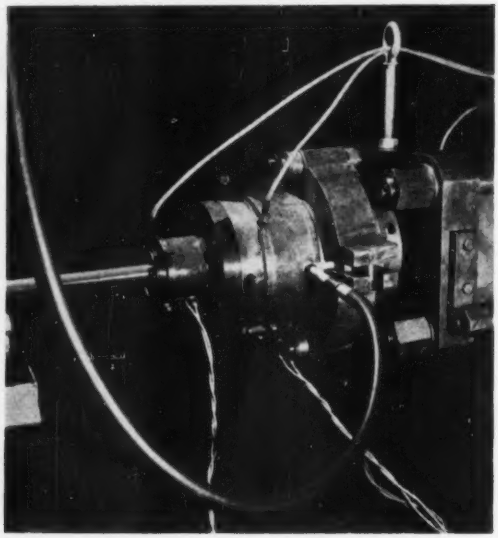
Fig. 3—Heating curve of an injection molding machine



EXTRUDE RODS, PIPING, SHAPES

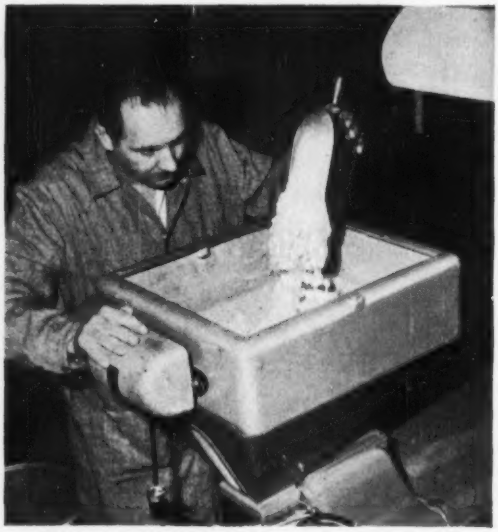


View of Stokes-Windsor Extruder shown handling unplasticized P. V. C.



Extruding 1" rigid pipe from Firestone Exon 402. Diameters from ½" to 2" have also been produced.

Exon 402 adapts easily, inexpensively to extrusion from pellet form.



In powder form, too, versatile Exon 402 can be extruded on a practical basis.

Photographs—Courtesy of Alpha Plastics Inc., West Orange, N. J.

Table 1—Heating Efficiencies (E) of Injection Molding Machines

Machine	*Manufacturer's rated capacity*	*E at rated capacity*	*Heating chamber rating at E = 0.8*
	lb./hr.		lb./hr.
A	40	0.65	15.5
B	70	0.66	32.0
C	80	0.66	37.0
D	80	0.72	56.5
E	300	0.57	108.0

couple nozzle. The production rate was found by weighing the material collected in a certain time interval. The heating efficiency was calculated from the measured average temperatures. Such heating capacity curves would be helpful to the molder in determining the production rate on particular molding jobs where mold construction or quality demand that a higher heating efficiency be used.

Production data on many representative types of molds could be collected and the heating efficiencies to produce good moldings determined. From these data an average value of heating efficiency that would produce good moldings in the majority of molds would be found and the production rate of a molding machine at this value would be given as the heating capacity of the molding machine. Although this number would not give a complete picture of the heating capacity, it would indicate the relative capacities of different machines in a more reliable manner than the present heating capacity figures. Since this figure is definitely not the maximum output, it might be more accurate to call it a "heating chamber rating" rather than a heating capacity.

To determine an average heating efficiency for comparing the five molding machines tested, it was assumed that if the control temperature was set at 450° F. the minimum temperature of the polymer should not be below 350° F.[2] This gives a mass average temperature of 375° F. with a corresponding heating efficiency of 0.8. This would mean that for the machine represented in Fig. 3 the heating chamber rating would be 37 lb./hour. It is interesting to note what would happen if this machine were producing 80 lb./hr. of molten polymer. From Fig. 3 it can be seen that at 80 lb./hr. the heating efficiency would be 0.66. With a control temperature of 450° F. the mass average temperature of the polymer would be 325° F. and some of the material would be as low as 255° F.[2] From these figures it is obvious why molders may encounter trouble when they try to use their machines at production rates near the rated capacity of the machine. Table I shows the results of temperature measurements made on the various injection machines.

It is also important for the molders and machine manufacturers to be able to compare the heating abilities of various designs of heating chambers, independently of their size. This can be done easily by dividing the production rate by some size factor of the machine. As has been pointed out by Sloane,[3] the present size rating of a machine is rather ambiguous and bears little relation to the heating capacity of the molding machine. A more accurate factor to use in comparing the heating abilities of various machines is the amount of material in the heating chamber. When the production rate is divided by the weight of material in the heating chamber, the resulting factor is the reciprocal of the heating time. Thus, different designs of heating chambers can be compared on an equal basis and the position of the heating ability curve will give the relative heating ability of an injection molding machine. By comparing the heating ability curve of a proposed design with the curves of other molding machines, the machine manufacturer can tell easily whether the new design is better in regard to heating polymer than present day machines. The heating ability curves of five different molding machines ranging in size from 4 oz. to 120 oz. are compared in Fig. 4. Even though these machines represent several manufacturers and a wide range of sizes, the curves are very similar.

Molding Material

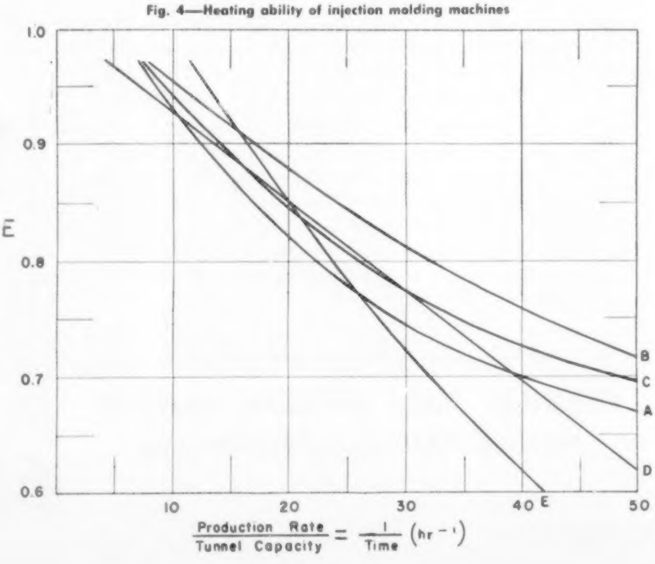
The dependence of the heating chamber rating on the temperature distribution has been discussed, but the heating chamber rating also depends upon the material being molded. It was found theoretically that this heating efficiency ($E = \frac{T_a - T_o}{T_i - T_o}$), could be directly related to the equa-

(*Continued on p. 204*)

[2] Minimum temperatures were computed from heat conduction theory and the design of the heating chamber.

[3] Sloane, D. J., S.P.E. Journal 8, 7, (Jan. 1952).

Fig. 4—Heating ability of injection molding machines



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Patio lounge chair manufactured by Houtz & Barwick, Elizabeth City, N. C. Tenite-coated tubing produced by Samuel Moore & Company, Mantua, O., under trade name Dekoron.

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

BRAKE LINING MANUFACTURE. H. Beever. Brit. Plastics 25, 146-50 (May 1952). Because of its heat stability and its felting properties, asbestos forms the basis of most brake linings. Of the various types of asbestos available, chrysotile is the most suitable, being easy to make into yarn on the "woollen" types of carding machines, especially if a small percentage of cotton or rayon staple is added, usually about 10%. Sometimes wire (brass or zinc) is incorporated. Up to the 1930's a woven brake lining relied on the brass wire holding the material together under service conditions, because the bonding and wear-resistant material was a thermoplastic, either rosin or bitumens or a mixture of both. At that time the general cruising speed of motor cars was lower than it is today and as the braking area of the lining was fairly large no great heat was developed. The next improvement was the addition of drying oils to give impregnating varnishes. Boiled-linseed, tung, and stilingia oils were used, and this led to modifications in the technique of brake-lining manufacture. About 1930 phenol-formaldehyde resins were incorporated with woven asbestos. Instead of having to use the asbestos and wire for strength it was now the exact reverse. It was no longer necessary to have solid woven asbestos cloth, but single cloths could be laminated to give a liner of any requisite thickness, and wire was not needed for strength. Because the straight resins had disadvantages from the frictional point of view, and yet on cooler brakes such exceptional life, means were found of incorporating oils and thermoplastics into the resins. Three lines of attack were tried. One was to make the resin into an oil-modified resin, with oil lengths of 1 to 2 of resin, and because this made the resins oil-soluble, any oil-soluble thermoplastic could be added. Another approach was the use of the Albertol type of synthetic resin, i.e., a phenolic-rosin product, which is oil-soluble and allows drying oils to be incorporated. The third method is the use of a phenolic resin chemically modified with a thermoplastic additive. This expedient has the effect of inhibiting the drop in friction value. If the brake lining made with such a resin is, as a final process of manufacture, heated at temperatures approaching 300° C. in enclosed vessels, some of the distillation products which can act as lubricants are driven off.

NEW APPLICATIONS AND DESIGNS OF PLASTICS. SPE J. 8, 16-18 (Apr. 1952). Some of the problems encountered by users of plastics are discussed by a panel of six.

Materials

ORGANIC ADSORBENTS. M. S. Bhatnagar. Ind. Eng. Chem. 43, 2108-12 (Sept. 1951). In 1935 Adams and Holmes reasoned that, because the phenolic hydroxyl group is not involved in the condensation of phenol with formaldehyde, the hydroxyl group should be free to ionize in the usual manner and is therefore available for ion exchange. The present work was undertaken to study the adsorption of acids, alkalies, and salts on various phenolic and amino resins. Increasing the number of hydroxyl groups in phenol or amino groups in amines gives, on condensation with formaldehyde, resins with greater adsorption capacity. Acid-condensed phenolic resins behave as less polar than water, whereas the alkali-condensed phenolic resins or amino resins behave as more polar than water, and the various results of adsorption obtained can be easily explained on the above concept. It should be possible to remove both cations and anions by the phenolic resins by simply changing the condensing agents in the process of resin formation. The results also explain the reversal of Traube's order experienced by various workers in the adsorption of fatty acids by these resins.

RESORCINOL-FORMALDEHYDE REACTION. P. J. Stedry. Ind. Eng. Chem. 43, 2372-5 (Oct. 1951). Synthetic fibers used in reinforcement of molded rubber goods are usually treated with an adhesive which is in part a condensation product of resorcinol and formaldehyde. This product is prepared in dilute water solution, using sodium hydroxide as catalyst. Because established methods of kinetics cannot be readily applied to control the manufacture, a convenient and accurate index of reaction velocity was sought. Ultraviolet transmittance of the solution decreases gradually and reproducibly as the condensation progresses. The change in transmittance was used to compare reaction rates between 1 mole of resorcinol and 1, 2, or 3 moles of formaldehyde in the temperature range from 55° to 110° F. Temperature coefficient and activation energy were found to be independent of the molar ratio, and the reaction time to a given end point could be expressed as an exponential function of temperature. The effects of various catalysts and concentrations were similarly studied. Transmittance data in the near-ultra-violet thus provide a tool for the rate study of phenolic condensations which take place in a single phase. Before this method can be applied to theoretical work, however, several error-introducing factors must be appraised more thoroughly.

SEPARATION AND IDENTIFICATION OF POLYMETHYLOL PHENOLS BY PAPER CHROMATOGRAPHY. J. H. Freeman. Anal. Chem. 24, 955-59 (June 1952). Hydroxybenzyl alcohols, commonly called methylolphenols, are believed to be the immediate product formed in the initial reaction of phenol with formaldehyde. However, no method exists by which the five possible individual mono-, di-, and tri-methylol compounds may be determined. Paper chromatography now provides a specific and highly-sensitive technique by which each of these substances may be separated and identification made. Presence of 2,4,6-trimethylolphenol, 2,4-dimethylolphenol, and 2,6-dimethylolphenol as well as p-hydroxybenzyl alcohol, saligenin, and residual phenol in an

* Reg. U.S. Pat. Office.

alkali-catalyzed mixture of phenol and formaldehyde has now been clearly demonstrated. Absence of *m*-methylolphenol and 3,3',5,5'-tetra (hydroxymethyl)-4,4'-dihydroxy-diphenylmethane can be simultaneously detected. As methylol formation is the first step in the phenolic resinification process, the presence or absence of a specific compound or isomer in the mixture may be of considerable importance in influencing the subsequent course of the reaction. A simple, easily conducted, and unambiguous method for tracing the existence of such isomers is now provided. It is conducted directly on the reaction mixture of any stage and requires no physical or chemical change in the system under investigation. The new technique should prove of considerable value to workers engaged in the study of both theoretical and practical aspects of the phenolic resinification process.

GR-S LATICES IN FOAM RUBBER. L. Talalay and A. Talalay. Ind. Eng. Chem. *44*, 791-5 (Apr. 1952). The job of the compounder in the rubber industry and the materials he works with are described briefly.

MODIFIED PHENOLICS. W. Goss. SPE J. *8*, 13-15 (Apr. 1952). The properties and some applications of rubber modified phenolic plastics are discussed.

Molding and Fabricating

MOLDING OF HEAVY SECTIONS. G. Thayer. SPE J. *8*, 5-11 (Apr. 1952). Four requirements for filling the mold during the injection molding of heavy sections are described. These are 1) fill the mold quickly, 2) load the correct amount, 3) trap the charge, and 4) avoid packing. Molding procedures are described in detail which fulfill all four requirements simultaneously. The most convenient method, and the most accurate, is the use of weighed-starved feeding. This method is recommended most highly of all because of the high degree of precision in control which it affords. Nozzle valves, gate valves, and pressure cut-off devices can be adapted to do a reasonably satisfactory job of molding heavy sections.

PRE-PLASTICIZING. R. W. Powell. SPE J. *8*, 11-16 (May 1952). The advantages of preplasticizing are discussed. They are: increase of plas-

ticizing capacity for a given machine; greater shot capacity; relatively strain-free molded parts; and reduction of weight of molded piece with consequent reduction of scrap and saving of money. A 300-oz. injection machine is described briefly.

Preplasticizing and Injection Machines. M. Freund. Brit. Plastics 25, 126-8 (Apr. 1952). The principles involved in preplasticizing and injection machines are discussed and some operational details described.

Quality Control. L. M. Debing. SPE J. 8, 7-10 (May 1952). The problem of statistical quality control as applied to various phases of plastics molding is discussed. The use of procedures of this type is recommended.

Applications

Automotive Plastics. J. Totten. SPE J. 8, 19-20, 22 (May 1952). The requirements for automotive plastics applications vary according to the part use. Plastics are used where they are superior to metal, or offer unique design advantages.

Multi-Way P.V.C. Tubing for Gases and Liquids. Brit. Plastics 25, 151 (May 1952). Multiple duct polyvinyl chloride plastic tubing for carrying gases and liquids is described.

Preparation of Standard Sodium Hydroxide Solutions by Use of a Strong Anion Exchange Resin. J. Steinbach and H. Freiser. Anal. Chem. 24, 1027-29 (June 1952). A procedure is described for preparing carbonate-free standard sodium hydroxide solution by using anion exchange resin.

Plastics in Furniture—a Critical Analysis. J. B. Singer. Plastics (London) 17, 89-91 (Apr. 1952). The construction of chairs, tables and sideboards is described.

PVC Extrusions for Industry. Applications of extruded polyvinyl chloride are reviewed in detail. The applications include those used on motor cars, for electrical conduits, concrete joints, water pipes, textile machinery, luggage, curtain hangers, industrial upholstery, household appliances, and decorative products.

PVC Materials in Boot and Shoe Manufacture. Brit. Plastics 25, 106-11 (Apr. 1952). The use of polyvinyl chloride plastic in the construction of boots and shoes in the United Kingdom is described. The types of material used, mostly unsupported sheeting and coated fabrics, and the details on boot and shoe parts made of these materials are discussed. Approximately 150 million pairs is the annual output.

Vinylidene Insoles for Korean Boots. Brit. Plastics 25, 82-5 (Mar. 1952). Insoles for boots are fabricated from screen made of saran filaments. The fabrication process is described in detail.

Building With Honeycomb Plastics. G. May. Plastics (London) 17, 92-4, 91 (Apr. 1952). The use of laminated honeycomb plastics in building construction in France is described.

Plastics-Bonded Carpets. G. May. Plastics (London) 17, 174-7 (June 1952). Natural and synthetic yarns are bonded together with polyvinyl chloride to make a new type of carpet. The process for making this product is described.

Properties

Thermal Conductivity of Anisotropic Materials. J. Freiling, R. E.

Eckert, and J. W. Westwater. Ind. Eng. Chem. *44*, 906-10 (Apr. 1952). Results indicate that directional conductivities of anisotropic materials can be obtained readily by the unsteady-state method. Laminated plastics have much higher thermal conductivities parallel to the layers than perpendicular to the layers. The ratio of the directional values of k may be as high as 6 to 1. The thermal conductivities along the two major axes parallel to the laminations may be nearly equal or may be quite different, depending upon the orientation of the filler material.

INFLUENCE OF RESIN COMPOSITION ON THE PROPERTIES AND STRUCTURE OF IMPROVED WOOD. H. E. Dadswell, J. S. Fitzgerald, and N. Tamblyn. Australian J. Applied Sci. *3*, No. 1, 71-87 (1952). Synthetic-resin-impregnated wood was manufactured using veneers from coachwood and various phenolic resins. The properties of the improved wood were determined, with special attention to the shear and impact strengths in relation to the particular resin used. Microscopic examination of sections cut from the improved woods shows that when advanced types of resins are used for impregnation, particles of resin are deposited in the cell cavities, whereas resins of very low molecular weight appear to be distributed in the cell walls of the wood. Variations which assisted the penetration of the resin into the wood cell walls are (a) keeping the wet, impregnated veneers block stacked for some days before drying, (b) the use of resins condensed only to the extent of combining all the formaldehyde without appreciable polycondensation, and (c) the use of phenol rather than cresol for making the resin. These changes in technique increase shear strength in the plane of the laminations but decrease the Izod impact strength. When the ratio of formaldehyde to phenol is high, 1.5 to 2.5, both the shear and impact strengths are lowered. Reduction of resin content from 40 to 25% does not materially reduce the shear strength of the improved wood but increases the impact strength.

WEAR RESISTANCE OF VULCANIZED ELASTOMERS. J. C. Burns and E. B. Storey. Ind. Eng. Chem. *44*, 825-30 (Apr. 1952). The lack of a satisfactory laboratory measure of the wear resistance of vulcanized elastomers

has hindered the development and acceptance of new elastomers for use in tire treads. On an abrasive paper test surface, comparable 41° and 122° F. GR-S tread vulcanizates were ranked in the reverse order of that observed in road tests, even after the extraction treatment described by Griffith et al. When a steel screen was used as the test surface on a National Bureau of Standards abrader, the 41° F. GR-S vulcanizate showed the higher wear resistance. The effects of state of cure, type and quantity of carbon black, and softener were similar to that reported for road tests. The screen provided a uniform test surface whose wearing action was maintained over long periods of service. The lower rate of wear on this surface resulted in an increase in the sensitivity of the determination.

Mechanical Properties of Plastics. Brit. Plastics *25*, 137-8 (Apr. 1952). Abstracts of the papers presented at the Mechanical Properties of Plastics Symposium sponsored by the Plastics and Polymer Group of the Society of Chemical Industry in March 1952 are presented. The papers covered the following three categories: (1) Fundamental relation of mechanical properties to molecular shape and size and to the composition of the system if heterogeneous. (2) Assessment of the practical use of a material by carefully selected tests. (3) The empirical comparison of different materials by standardized tests.

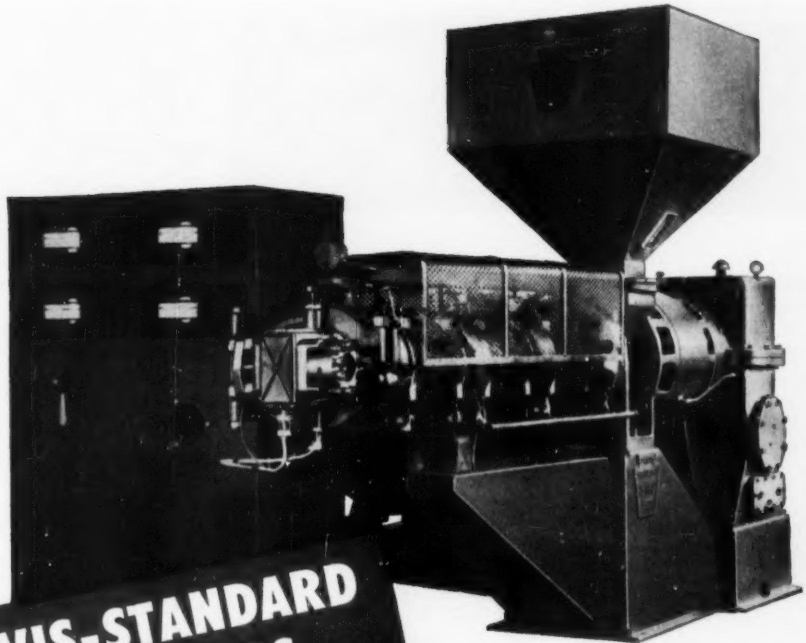
Testing

ASTM Definitions of Terms Relating to Methods of Testing. ASTM Bulletin *1952*, No. 182, 66-70 (May 1952). A list of proposed definitions of terms and symbols relating to the tension testing of plastics is presented and discussed.

Basic Degree of Polymerization of Cellulose Acetate. L. A. Cox and O. A. Battista. Ind. Eng. Chem. *44*, 893-6 (Apr. 1952). A practical procedure for measuring the basic degree of polymerization of cellulose acetates, irrespective of acetyl content, by simultaneous solution and complete deacetylation in cuprammonium hydroxide is shown to have important advantages and much wider application than the usual organic solvents.

For example, cuprammonium solvent may be used to dissolve mixtures of cellulose and cellulose acetates, or cellulose acetates having very wide spreads in acetyl composition. Such mixtures are insoluble or only partially soluble in organic solvents.

Use of the cuprammonium solvent for cellulose and the acetate derivatives of the cellulose permits direct comparison of chain length variations, because a polymer-homologous system is always maintained. The uncertainties and inconvenience of measuring K_m values for each range of acetyl content in various organic solvents are eliminated entirely. However, within a relatively narrow range of acetyl content (38 to 41%), the specific viscosities of cellulose acetate solutions measured at 0.50% concentration in an acetone-water (96-4) solvent are shown to be related in a direct manner to the measured basic degree of polymerization obtained by the cuprammonium method. A conversion curve is drawn to facilitate the conversion of such data.



DAVIS-STANDARD EXTRUDERS

Davis-Standard 6"
Thermoplastic Extruder

...ENGINEERED TO YOUR OPERATING NEEDS

Every feature of our extruders for rubber or plastics is the result of long experience in the extrusion industries and intimate knowledge of production problems.

Davis-Standard "Stream-Flo" insulating heads permit the most efficient operating velocities. All head equipment is compact, accessible and easy to clean. For thermoplastic applications, sectional-type cast steel cylinders afford precise temperature control as well as maintenance advantages. Each section has wear and corrosion-resistant liners.

Another exclusive feature of Davis-Standard plastic extruders is the "Therma-Fin"* heating jacket, with range-type tubular heating elements and stainless steel cooling coils cast into aluminum cooling fins.

*Patent Pending

With this construction any desired temperature condition may be obtained.

Feed section is a separate casting. Stock screws are of special steel alloy, normally bored for water cooling. Variations for depth and lead are available for different compounds. Drive is V-belt or flexible coupling to enclosed worm reduction gear. Davis-Standard machines are furnished complete, including control panel, ready for installation.

Our engineers will welcome the opportunity to work with your engineers on your problems. Our extensive experience in custom-built equipment will fit the installation to your exact requirements.

THE STANDARD MACHINERY COMPANY

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MOLDING PRESSES AND EXTRUSION MACHINES
WORLD'S LARGEST MANUFACTURERS OF CUSTOM-BUILT EXTRUSION MACHINES
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Export Office: Ballagh & Thrall, Independence Square, Philadelphia 6, Pa.

U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

UREA RESINS. R. T. K. Cornwell (to American Viscose). U. S. 2,595,-335, May 6. Molding powders from urea and gaseous formaldehyde.

POLYESTERS. J. G. N. Drewitt and J. Lincoln (to Celanese). U. S. 2,595,343, May 6. Polyester reaction products of dicarboxylic acids and diphenols.

POLYUREAS. J. T. Maynard (to Du Pont). U. S. 2,595,400, May 6. Polymeric polyureas.

CELLULOSE ESTERS. G. A. Richter, Jr. (to American Viscose). U. S. 2,595,410, May 6. Cellulose esters modified with an aldehyde.

PLASTIC TUBING. K. F. Spalding (to W. F. Stahl). U. S. 2,595,421, May 6. Plastic sealing machine.

UREA RESINS. J. K. Simons (to L-O-F Glass). U. S. 2,595,492, May 6. Furfuryl urea-formaldehyde thermosetting resins.

POLYMERIZATION. H. C. Highet, F. E. Salt, and H. M. Stanley (to Distillers). U. S. 2,595,581, May 6. Thermal polymerization of alpha-methyl styrenes.

STABILIZER. H. T. Voorthuis (to Shell). U. S. 2,595,619, May 6. Mixtures of diamides of carbonic acid and epoxy compounds to stabilize high molecular weight halogen compounds.

COPOLYMERS. R. J. Agnew (to Texas). U. S. 2,595,625, May 6. Copolymers of polyesters and conjugated dienes.

ORGANOSILOXANES. J. Swiss and C. E. Arntzen (to Westinghouse). U. S. 2,595,727-8-9-30, May 6, Organosiloxanes containing methallyl silicon oxide-allyl groups and articles manufactured therefrom.

COPOLYMERS. J. R. Dudley (to American Cyanamid). U. S. 2,595,-779, May 6. Copolymers of halogenated unsaturated polycarboxylic acids and poly-unsaturated compounds.

RESIN COMPOSITIONS. G. E. Hamm (to Chemstrand). U. S. 2,595,847-8, May 6. Composition of diethyl phosphite and a copolymer of acrylonitrile.

SILOXANES. R. O. Sauer (to General Electric). U. S. 2,595,890-1, May 6. Linear methyl polysiloxanes and cyclopolysiloxanes.

COPOLYMERS. W. M. Thomas and J. A. Price (to American Cyanamid). U. S. 2,595,907, May 6. Acrylonitrile - dialkylaminopropylacrylamide compositions.

HEAT-SET INKS. W. S. Ropp (to Hercules). U. S. 2,595,983, May 6. Heat-set inks comprising polyvinyl terpene ethers.

WET-STRENGTH PAPER. J. R. Dudley and J. A. Anthes (to American Cyanamid). U. S. 2,596,014, May 6. Wet-strength paper using polyarylbiguanide-urea resin.

POLYSILOXANES. W. J. Wormuth (to General Electric). U. S. 2,596,-085, May 6. Elastic hydrocarbon-substituted polysiloxanes catalyzed with ammonium carbonate.

PLASTIC FORMING. M. C. Sutton. U.S. 2,596,184, May 13. Shaping a sheet of screen material over a frame, applying a layer of fabric impregnated with self-curing resin thereover, and curing.

RESIN. L. M. Geiger (to Neville). U.S. 2,596,235, May 13. Terpene-phenolic resinous reaction product.

CREASEPROOFING. H. W. Meijer. U.S. 2,596,268, May 13. Creaseproofing cellulosic textiles with glucose-ureide formaldehyde condensates.

CONDENSATION. J. Nichols and V. S. DeMarchi (to Interchemical). U.S. 2,596,279, May 13. Condensation of an allylic alcohol and a conjugated diene.

PRINTING PLATE. H. Oettinger, Jr. (to Electrographic). U.S. 2,596,715, May 13. Mortised printing plates using thermosetting and thermoplastic resins.

INTERPOLYMERS. R. W. H. Tess, R. H. Jakob, and T. F. Bradley (to Shell). U.S. 2,596,737, May 13. Interpolymer of a monoaryl-2-alkene-1 and an olefinically unsaturated polyester.

ADHESIVE. H. R. Moulton and J. Mahler (to American Optical). U.S. 2,596,863, May 13. Optical laminating cement containing ethylene glycol dimethacrylate.

RUBBER HYDROHALIDE. G. J. Van Veersen (to Rubber-Stichting). U.S. 2,596,878, May 13. Process for preparing rubber hydrohalide.

RESINS. D. W. Kaiser (to American Cyanamid). U.S. 2,596,930, May 13. Biguanide-aldehyde condensates.

WELDING. E. L. Kirk (to Dow). U.S. 2,596,933, May 13. Machine for welding superposed layers of plastic film.

GLOWPROOFING. M. L. Nielson and H. K. Nason (to Monsanto). U.S. 2,596,936-7-8-9, May 13. Glowproofing and fireproofing treatments containing phenol-aldehyde resins and nitrogen-phosphorus compounds.

COPOLYMERS. E. C. Shokal and C. W. Schroeder (to Shell). U.S. 2,-596,945, May 13. Copolymers of 1-alkenyl nitriles and aromatic dicarboxylic allylic esters.

ORGANOSILICON POLYMERS. L. W. Frost (to Westinghouse). U.S. 2,-596,967, May 20. Fluorine-containing organosilicon copolymers.

POLYMERIZATION. J. H. Bannon (to Standard Oil). U.S. 2,596,975, May 20. Slurry polymerization of isobutylene with another olefin.

INJECTION. S. L. Gookin (to United Shoe Machinery). U.S. 2,596,993, May 20. Method and mold for covering eyelets by plastic injection.

DIISOCYANATE RESIN. G. O. Orth, Jr. (to Armour). U.S. 2,597,025, May 20. Aromatic diisocyanate-water resinous reaction product.

HOLLOW ARTICLES. P. R. Hawfin

(to British Celanese). U.S. 2,597,098, May 20. Making hollow articles from cellulose esters.

RESINS. P. D. May and R. J. Lee (to Pan American Refining). U.S. 2,597,159, May 20. Condensing aromatic hydrocarbons with formaldehyde in the presence of formic acid.

RESINS. J. A. Otto and E. E. Gilbert. (to Allied Chemical). U.S. 2,597,171, May 20. Chlorine containing condensates of phenols and sulfonated acetaldehydes.

INTERPOLYMERS. P. O. Tawney (to U.S. Rubber). U.S. 2,597,202, May 20. Soluble interpolymers of a poly-2-alkenyl ester, vinylidene chloride, and a mono-unsaturated 2-alkenyl compound.

ION EXCHANGE. G. W. Bodamer (to Rohm & Haas). U.S. 2,597,437-8-9-40, May 20. Polymers of the carboxylic acid, sulfonic acid, weakly basic, and strongly basic types.

SYNTHETIC RESINS. J. W. Fisher and E. W. Wheatley (to Celanese). U.S. 2,597,467, May 20. Polymerizates of formaldehyde, a hydrazide of a dicarboxylic acid, and a compound condensable with formaldehyde.

ION EXCHANGE. J. C. H. Hwa (to Rohm and Haas). U.S. 2,597,491-2-3-4, May 20. Anion and cation exchanging polymers of vinylanisole.

EXTRUSION. D. J. Weber. U.S. 2,597,553, May 20. Apparatus for lubrication of plastic materials during extrusion.

PLASTIC ARTICLES. J. Bailey (to Plax). U.S. 2,597,558, May 20. Extrusion molding of hollow plastic articles.

CELLLULOSIC MATERIALS. N. Drisch and A. Petiton (to Textile and Chemical Research). U.S. 2,597,624, May 20. Incorporating partly condensed linear polyester in a viscose spinning solution.

CELLULOSE FIBERS. N. Drisch and P. Herrbach (to La Cellophane). U.S. 2,597,625, May 20. Applying a copolymer of vinyl chloride and vinylidene chloride to a regenerated cellulose base.

RESINS. E. F. Izard and L. A. Auspos (to Du Pont). U.S. 2,597,643, May 20. Highly polymeric polymethylene terephthalate.

MOLDING. C. V. Carlson (to Cosom Industries). U.S. 2,597,704, May 20. Process of making hollow bodies from fusible plastic.

LAMINATING. M. T. Goebel and R. K. Iler (to Du Pont). U.S. 2,597,721, May 20. Werner-type metal compounds as laminating and coating compositions.

AMINOPLASTS. H. J. West (to American Cyanamid). U.S. 2,597,766, May 20. Nitroalcohol phosphate curing catalyst for aminoplasts.

POLYAMIDES. J. D. Czarnecki (to American Can). U.S. 2,597,855, May 27. Polyamides plasticized with 2,2-di-(4-hydroxy-propoxy-phenyl) propane.

STABILIZER. R. T. Carroll (to B. F. Goodrich). U.S. 2,597,920, May 27. Heat and light stabilizers for chlorinated polymers comprising organotin compounds.

VINYL RESINS. J. Harding (to Carbide and Carbon). U.S. 2,597,987, May 27. Vinyl chloride resins stabilized with a hydrocarbon tin salt of a carboxylic acid.

EXPANDED PLASTICS. R. L. Stander (to U.S. Rubber). U.S. 2,598,077-8,

May 27. Use of arylazo triarylmethanes as blowing agents for plastics.

RESINS. W. M. Hutchinson (to Phillips Petroleum). U.S. 2,598,174, May 27. Resins from carboxyalkyl ethers of polyhydric alcohols.

COATING. A. S. Jones and G. B. Stackpole (to Joseph Bancroft and Sons). U.S. 2,598,264, May 27. Method of applying a discontinuous coating of thermosetting resin to a textile.

COPOLYMERS. W. T. Miller (to U.S.). U.S. 2,598,283, May 27. Preparation of clear sheets of copolymers of perfluoropropene and tetrafluoroethylene.

RESIN COMPOSITION. F. E. Newman (to U.S. Rubber). U.S. 2,598,-289, May 27. Composition of cashew nut shell-modified phenolic resin and a rubbery copolymer of butadiene and acrylonitrile.

INTERPOLYMERS. P. O. Tawney (to U.S. Rubber). U.S. 2,598,316, May 27. Interpolymers of a 2-alkenyl 2-alkenoate, a 2-alkenyl alcohol, and another monoolefin.

POLYMERS. W. E. Hanby, S. G. Waley, and J. Watson (to Courtaulds). U.S. 2,598,372, May 27. Production of polymeric compounds from anhydrocarboxy-alpha-aminocarboxylic acids in nitrobenzene.

SILOXANE RESIN. G. R. Lucas (to G.E.). U.S. 2,598,402, May 27. Polysiloxane resins hardened with lead tetraphenyl catalyst.

PLASTICIZERS. R. W. Martin (to G.E.). U.S. 2,598,406, May 27. Methylol phenol esters.

POLYMERS. G. S. Martel (to Du Pont). U.S. 2,598,407, May 27. Cellulose acetate-chloroacetate cross-linked with a polythiol or a mercaptide.

CYCLOPENTADIENE COPOLYMERS. C. F. Peters (to Velsicol). U.S. 2,598,-424-5, May 27. Reaction products of cyclopentadiene with tall oil and rosin, abietic acid, etc.

VINYL HALIDE POLYMERS. T. F. Bradley and D. E. Winkler (to Shell Development). U.S. 2,598,496, May 27. Salt of a hydrocarbon-substituted benzoic acid as stabilizer.

VINYL CHLORIDE. J. Dazzi (to Monsanto). U.S. 2,598,636, May 27. Vinyl chloride polymer plasticized with a tetracarboxylate.

POLYMERS. J. E. Fields and G. L. Wesp (to Monsanto). U.S. 2,598,639, May 27. Low molecular weight nitrogenous acrylate polymers.

COATINGS. P. E. Marling (to Monsanto). U.S. 2.598,644-5. May 27. Styrenated oil, styrene oxide-phenol resin drying oil coatings.

POLYCHLOROETHYLENES, A. H. Maude and D. S. Rosenberg (to Hooker). U.S. 2,598,646, May 27. Production of polychloroethylenes.

COPOLYMERS. E. L. Kropa (to American Cyanamid). U.S. 2,598,-663-4, June 3. Copolymers of unsaturated alkyd resins and acrylamido compounds.

CELLULOSE DERIVATIVES. C. R. Dolmetsch and S. B. McFarlane (to Celanese). U.S. 2,598,767, June 3. Reacting a cellulose ester with an N-alkoxymethyl polyurethane.

POLYMERIZATION. J. E. Mahan and S. D. Turk (to Phillips Petroleum). U.S. 2,598,811, June 3. Polymerization of aromatic nitriles.

NEW MACHINERY AND EQUIPMENT

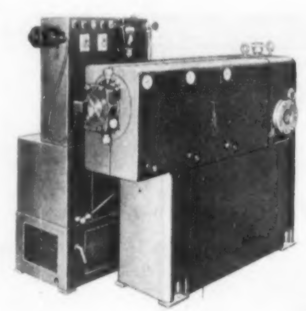
Metering Pump—The Robinson metering pump is of the positive gear type which forcibly ejects fluid components with an accuracy of ±3% at a rate of 88 ejections per minute by means of a single revolution clutch controlled by an insulated clutch lever, according to the manufacturers, the Edward E. Robinson, Inc., 95 Park Ave., Nutley 10, N. J. Adjustments can be made in less than 2 seconds. Viscosity of the material being handled is controlled by heat; thermostats determine the amount of heat applied to the insulated tank and gear housing.

Compression Press for Large and Small Moldings—F. J. Stokes Machine Co., Philadelphia 20, Pa., announces the Model 726 compression press in either 100- or 200-ton size. The main cylinder and bed of the press are cast in a single piece so that no gaskets are required; the chamber is fully leakproof. All

molding steps are determined by the Stoker Bar Controller through a simple arrangement of buttons. A three-speed controlled closing reduces closing time of the press and eliminates potential mold damage; a double-acting ram eliminates external pull-back cylinders.

Air-powered Work Feeder—The two-station, electrically controlled work feeder is said to reduce idle machine time. Called the "Transfeed," it is the latest addition to the line of controlled air-power devices manufactured by The Bellows Co., 230 West Market St., Akron 9, Ohio. It measures 5¼-in. wide by 12-in. long, and is guided between dovetail ways. The 6-in. transverse positioning stroke allows the operator to load and unload work at one station while the machine operates at the other.

Oil-heated Extruder—The Model 50 extruder has been announced by National Rubber Machinery Co., Akron 8, Ohio. The 2½-in. oil-heated

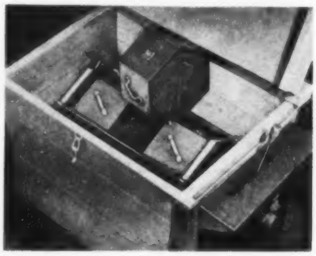


extruder features totally enclosed drive transmission with a heavy duty cone worm gear reduction unit. Many of the parts have been standardized for the other NRM 2½-in. extruders.

Mask-washing Machine—A portable pneumatic spray mask washing machine has been announced by Sepanski & Assocs., 409 Henry Ave., S.E., Grand Rapids, Mich. The machine operates entirely on air pressure and requires a minimum pressure of 50 pounds. The cleaning cycle is automatic and can be set for any time required by the solvent to dissolve the material. At the completion of the cycle, the solvent is automatically returned to a closed reservoir within the washer. Any solvent may be used in the machine.

The smaller model of the washer (W-52-V) has a capacity of 5 gal. of solvent, and is 22 in. long, 16 in. wide, and 37 in. high with a mask area of 16 by 14 inches. The larger model (W-52-H) has a 10 gal. solvent capacity, measures 35 in. long, 16 in. wide, and 37 in. high and has a mask area of 33 by 16 inches.

Small Parts Tumbler—Tumbling barrel has 2 to 6 pockets for deburring, polishing, and finishing as many lots of small parts simultaneously. The pocket tumbler, manufactured by Tumb-L-Matic, Inc., 4510 Bullard Ave., New York 70, N.Y., has a set-up of removable pockets which save reloading time and allow con-



tinual operation. Pockets range from 12 to 16 in. in diameter and units are available with variable speed drives for further versatility. The submerged model illustrated is used for wet tumbling; a self-contained model is also available for wet and dry tumbling at the same time.

Time Delay Switch—By providing controlled time dwell at positive stops on either end of the cylinder movement, a time delay switch manufactured by Pneu-Trol Devices, Inc., 1438 N. Keating Ave., Chicago, Ill., increases the possible applications of air and hydraulic cylinder power in controlling machine movements. The switch is provided with a wide variety of thrust linkages for either right or left downthrust, upthrust, or horizontal thrust actuation. It can be furnished to dwell in any 20 to 1 ratio from a minimum of ¼ sec. to a maximum of 60 seconds. Changing of the liquid viscosity in the dash-

pot provides variation in the dwell ratios. Time delay adjustments within the 20 to 1 ratio are made by turning the knurled adjusting screw on the switch housing.

The switches are available in explosion proof and vapor sealed types and can be easily mounted at the cylinder.

Hydraulic Hot Plate Press—A new line of "floor-type" hydraulic hot plate plywood presses has been announced by Columbia Machinery and Engineering Corp., Hamilton, Ohio. Each press is a compact, one-piece unit mounted on a heavy steel base plate with the pumping system set up on this plate under the lower platen. The only connections necessary for the installation of the machine are a 110 volt single phase circuit for controls, a 220 or 440 volt line for pump motors, and steam and condensate return lines.

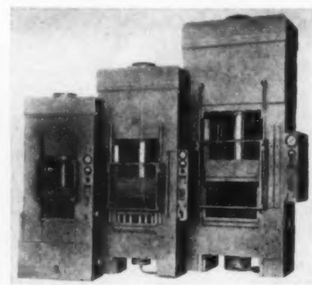
Special features of the press include a maximum platen pressure of 520 tons and an automatic recording type platen pressure controller with air-operated diaphragm steam valve which permits operation at regular steam line pressures up to 80 pounds. The vane type high volume pump and the piston-type high pressure pump of the pressure unit are run by a single 7½ hp. motor. Controls for the press are in an enclosed control panel mounted on a pedestal and consist of manual open and close buttons and an automatic timer, press opener, and reset. Manual pressure control valve and pressure gate are mounted at the side of the press under the lower platen.

British Compression Press—Presses for compression and transfer molding, manufactured by British Industrial Plastics Ltd., 1 Argyle St., London, W.1, England, feature auto-control mechanisms for the molding cycle and a "stepped-up" hydraulic drive system.

The auto-control mechanism insures consistent results once the optimum molding cycle has been determined. Hydraulic valves are operated from air pilots on the auto-control, which consists essentially of a revolving drum to which adjustable pegs are fixed; the pegs operate the appropriate valves in sequence. A second timer stops the drum for the cure period; this period may thus be adjusted independently of the rest of the cycle. Other automatic gear may also be attached to the main timer.

The BIPEL hydraulic drive system is claimed by the company to give excellent economy, especially when operating multiple installations up to 12 presses.

The basic principle is to generate a medium pressure with a simple inexpensive vane pump and step-up the pressure to a high value by a continuous acting hydraulic intensifier at each press. The drive consists of four units: a vane pump, a gas-



loaded rubber bag accumulator, a special BIPEL unloading valve and the BIPEL intensifier which furnishes either straight, 2:1 or 3:1 intensification ratios. A pump driven from this pumping system is said to have a choice of three pressures—from 1000 to 3000 p.s.i.

The BIPEL Type 40 press is capable of 20, 40, and 60 English tons; the type 100 press gives 50, 100, and 150 tons; and the Type 200 press gives 100, 200, and 300 tons.

Guided Platen Press—Designed for molding reinforced plastics, a line of electrically powered, hydraulically operated guided platen presses has been developed by the Dake Engine Co., Grand Haven, Mich.

An adjustable pressure switch limits the pressure applied during the cure to any desired amount from half to full rated load of the press. An electric timer retains this pressure for the duration of the curing cycle—adjustable from 12 to 400 seconds. At the end of the cycle, the movable platen returns automatically to starting position.

Standard press capacities range from 25 to 300 tons. The presses can be custom engineered to meet specific requirements.

BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Chemical Engineering Operations," by F. Rumford.

Published in 1952 by Chemical Publishing Co., Inc., 212 Fifth Ave., New York 10, N. Y. Price $7.50.

Basic principles of the operation of chemical plants, important processes used in the chemical industries, and principal types of apparatus for carrying out each process are described and illustrated in this book. The theoretical aspects of chemical works procedures, including their mathematical foundations, are covered, and processes and equipment are evaluated from the viewpoint of efficiency and economy. Illustrative examples, including the calculation of results and graphical presentation, are listed for every operation cited.

"Controllership—The Work of the Accounting Executive," by J. Brooks Heckert and James D. Willson.

Published in 1952 by The Ronald Press Co., 15 E. 26 St., New York 10, N. Y. 645 pages. Price $7.50.

This working guide presents a complete picture of the duties and responsibilities of the controller. General chapter headings cover the function of controllership, accounting control of operations, accounting reports, and administration of the controller's department. Particular problems under discussion include procedures for physical inventory, tax records, insurance records, corporate ownership and long-term debt, and the controller's contribution to industrial relations. Supplementary data contained in the book include 173 forms, tables, reports, charts, and graphs.

"Glycols," edited by George O. Curme, Jr. and Franklin Johnston.

Published in 1952 by Reinhold Publishing Corp., 330 W. 42 St., New York, N. Y. 389 pages. Price $12.00.

Glycols now in commercial production or which have been or could be manufactured on a commercial scale are covered in this comprehensive review. The subject matter is treated from a technical point of view, principally in terms of ethylene glycol and propylene glycol. Separate chapters deal with production, physical properties, applications, oxides, derivatives, and condensation polymers, with the remainder of the book devoted to higher glycols, toxicological data, and analytical methods. Special emphasis is given to manufacturing techniques, the condensation polymers of ethylene and propylene glycols, and details of the two commercial methods for producing ethylene oxide—via ethylene chlorohydrin and by direct oxidation of ethylene.

Du Pont's story—In celebration of their 150th anniversary, the Du Pont Co. has prepared a 138-page book covering the history and growth of the company from its founding in 1802. At the same time, the book covers those phases of American history that accompanied and played a large part in Du Pont's story. The book is heavily illustrated with photographs, line drawings, and 4-color paintings. It is being distributed primarily to employees and stockholders. *E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.*

French Directory—A directory of the plastics industry and its suppliers in France is offered in this 700-page Fourth Annual edition of France-Plastiques. Information on the directory may be had from Societe de Creations Editions et Productions Publicitaires, 27 Rue Laffitte, Paris IX, France.

Styrene latices—Adhesive characteristics and mechanical stability of Lustrex styrene latices are outlined in this bulletin. Also included are typical formulations, solvents, plasticizer applications, fillers, and blends with polyvinyl acetate and rubber latices. Low cost, water resistant adhesives compounded from Lustrex latices that have excellent bonds to a variety of surfaces are discussed. *Plastics Div., Monsanto Chemical Co., Springfield, Mass.*

Styrene molding powder—Molding and finishing of Lustrex LH, the company's improved impact styrene molding powder, are discussed in Production Information Bulletin No. 76. Lustrex LH combines the advantages of general purpose styrene with some desirable properties of high impact materials; it is up to 100% more resistant to breakage than general purpose material, has superior molding characteristics, and approaches the desirable gloss of general purpose molding powder. *Plastics Div., Monsanto Chemical Co., Springfield, Mass.*

***n*-Butyl alcohol**—Chemical, physical, and physiological properties; solubility and shipping data; and applications of *n*-butyl alcohol are described in this four-page technical information bulletin (F-7909). Also discussed is the product's use in the preparation of chemicals for synthetic resins, plastics, plasticizers, rubber accelerators, dyestuffs, weed killers, pharmaceuticals, and flavorings, and coatings for leather, paper, and textiles. *Carbide and Carbon Chemicals Co., 30 E. 42 St., New York 17, N. Y.*

Upholstering instruction chart—Illustrating recommended methods of upholstering with Velon flex is a wall chart, measuring 19 in. by 24 in., designed as an easily referable display for workmen. Diagrams of all upholstering procedures are given under such headings as frame preparation, cutting, welting, stitching, breathers, and tacking, with special instructions for the construction of such items of furniture as; sofa beds, slip seats, spring tight seats, and platform rockers. *Firestone Plastics Co., Pottstown, Pa.*

Catalytic cracking—Engineering developments in fluid catalytic cracking are reviewed in this current issue (No. 1) of the company house organ, "Kelloggram." *M. W. Kellogg Co., 225 Broadway, New York 7, N. Y.*

Laboratories directory—The sixty members of the American Council of Commercial Laboratories, Inc., are

classified in this 1952 revised edition of their annual directory. Each of the laboratories are indexed as to address, scientific and technical personnel, professional services, equipment and facilities, scope of research and development services available, and the technical societies and organizations to which each belongs. *American Council of Commercial Laboratories, Executive Secretary, 4302 East-West Highway, Washington 14, D. C.*

Gage blocks—Use of gage blocks is greatly simplified by means of the tables and calculations included in this "Height-Combination Tables—Heat Expansion Calculator Book." The first part of the book provides a listing of the gage blocks to be used in constructing combinations for any dimension from 0.0001 in. to 1 in. in steps of 0.0001 inch. The book is available through the company's sales-service stores for $2.95. *DoALL Co., Des Plaines, Ill.*

Metallic stearates—Revised specifications of many grades of metallic stearates are described in this booklet. The revisions include controls on the purity and uniformity of the component fatty acids and extremely low limits of lead and arsenic. Also included in the booklet is a listing of the entire line of metallic stearates produced by the company. *American Cyanamid Co., Industrial Chemicals Div., 30 Rockefeller Plaza, New York, N. Y.*

Thread-cutting screws—Thread and point data on the different sizes available in each of the commonly used types of thread-cutting screws manufactured by the company for assembly work in plastics, sheet steel, and die castings, are tabulated in this 4-page engineering folder (S-49A). *Reliance Div., Eaton Mfg. Co., Adv. Dept., Massillon, Ohio.*

SS Nitrocellulose—Technical information on SS Nitrocellulose is offered in this revised 12-page booklet. As an aid to the formulator, twenty charts which illustrate studies in solubility of the material are included. *Cellulose Products Dept., Hercules Powder Co., Wilmington 99, Del.*

Vinyl dispersions—The compounding, processing, and applications of

vinyl dispersions are discussed in this 86-page supplementary chapter for the second edition of the S.P.I. handbook. Organosols, plastisols, and plastigels are covered as to types, characteristics, pigmentation, method of manufacture, storing, and aging characteristics, and fusion. Another section is devoted to various methods of using vinyl dispersions, including spread-coating; casting film; dip-coating; slush-molding; cavity molding; injection molding; extrusion; and spraying. Also covered are embossing of vinyl-dispersion films; low-temperature fusing of plastisols; and expanded plastisols. The booklet is illustrated with charts, diagrams, photographs, and schematic drawings. It is available for $1.50 to $2.25 per copy, depending on the quantity purchased, from *The Society of the Plastics Industry, Inc., 67 W. 44 St., New York 36, N. Y.*

Instrument sensing units—Application recommendations, prices, and pertinent information concerning the company's instrument sensing units and associated accessories are contained in this 42-page data book and catalog. Among the items listed are base metal thermocouples; resistance bulbs and wells; radiation detectors; special thermocouples for plastic injection and extrusion machines; molten metal thermocouples for ferrous metals; protecting tubes; and accessories. The catalog is illustrated with photographs and dimension drawings. *Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill.*

Vacuum metallizing—The basic principles of vacuum metallizing and how it can be applied to the surfaces of plastics, metals, glass, paper, textiles, and leather are described in this 12-page brochure (No. 725). The complete process, including pretreatment, drawing of vacuum, metallizing, and finishing are outlined and schematically illustrated. Also discussed are recent developments in the field, cost comparisons, and the various kinds of coating now available for vacuum metallizing purposes. *F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa.*

Plastolein plasticizers—The company's complete line of Plastolein plasticizers are covered in this 24-page booklet, which contains specifi-

cations and properties for Plastolein 9050 DHZ (di-2-ethylbutyl azelate); 9058 DOZ (di-2-ethylhexyl azelate); 9055 DGP (diethylene glycol dipelargonate); 9250 THFO (tetrahydrofurfuryl oleate); 9715 Polymeric; and 9720 Polymeric. Other information relates to the testing of plasticizers. *Emery Industries, Inc., Dept. 5, Carew Tower, Cincinnati 2, Ohio.*

Hydraulic presses—The company's 75th anniversary is celebrated with this 36-page booklet entitled, "It Started With An Apple." The booklet presents the pictorial story of the progress of the company from its original hydraulic cider press to today's modern presses. *The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.*

Users of compression molded plastics—A complete picture of the company's services and facilities—engineering, materials selection, precision mold making, molding, and finishing—is compiled in this 10-page booklet. Two charts are included to help product designers—minor diameters of threaded inserts and pin diameters, and major diameters of screw threaded inserts with tolerances allowed. *Kuhn & Jacob Molding & Tool Co., 1200 Southard St., Trenton, N. J.*

Information at work—Tracing the development of instruments—from the simplest to those which indicate, record, and control the most complex process—is a 30-min., full-color film. This film is of interest to people in the process industries, technical schools, technical societies, and middle management people concerned with the specifying and purchasing of control instruments. *Taylor Instrument Companies, 95 Ames St., Rochester 1, N. Y.*

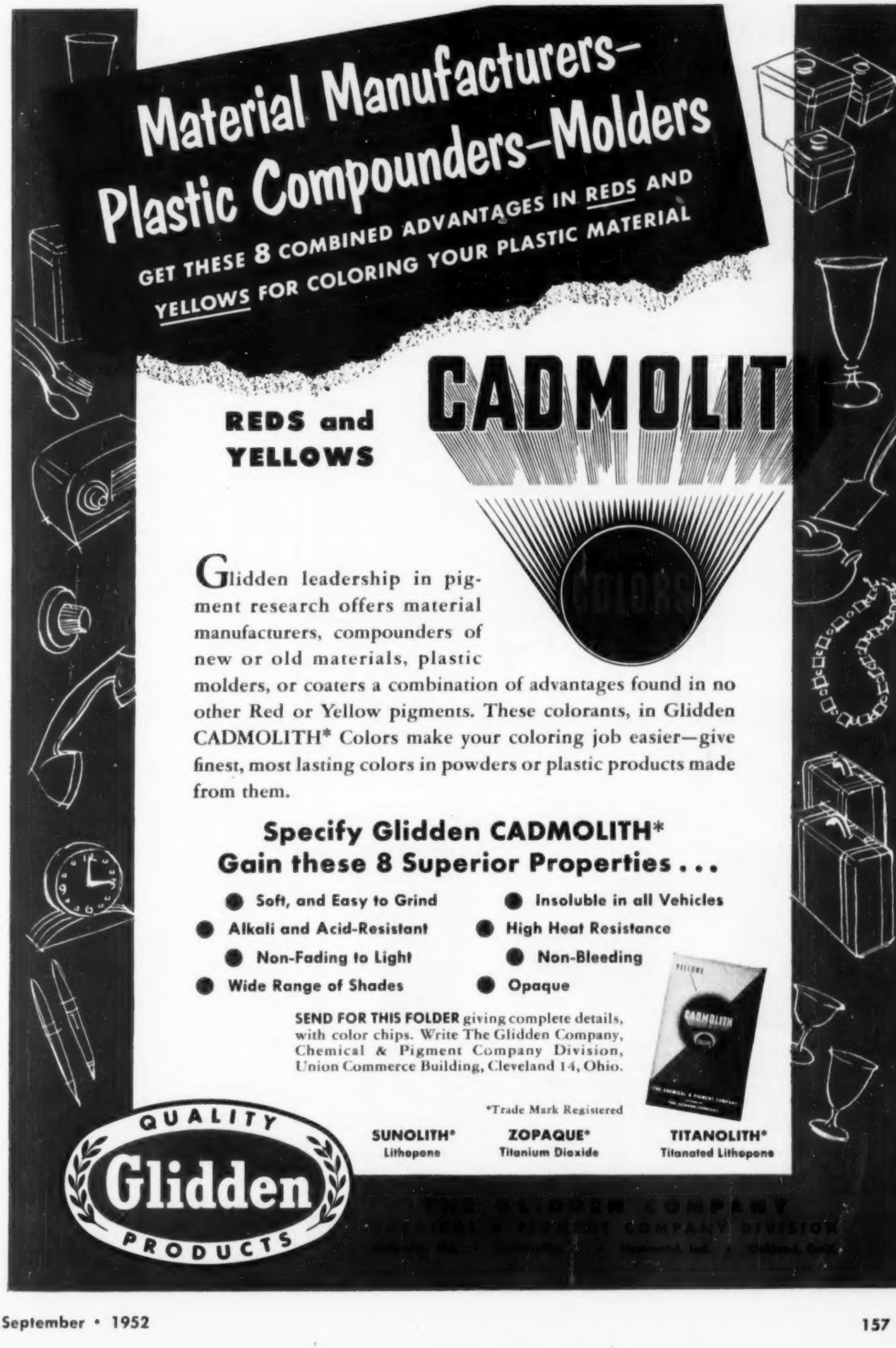
Plasticizer—Properties and uses of di-(2-ethylhexyl) adipate (DOA) as a primary plasticizer for vinyl resins are described in a two-page Technical Service Report (E-3). DOA is used in such vinyl applications as film, sheet, extrusion, dip coatings, and slush molded products. *Witco Chemical Co., 295 Madison Ave., New York 17, N. Y.*

Intermix—Methods of operating and maintaining a heavy duty internal mixer are described in this new 20-page illustrated brochure. Diagrams show the rotor design, mixing chamber, gear transmission, and temperature control. A complete lubrication section is also included. *Francis Shaw & Co., Ltd., Corbett St., Ashton New Road, Manchester 11, England.*

Resin adhesives—Technical information and instructions for use of Melurac resin 300 and Urac resin series are available in a new brochure. The Urac series includes Urac resins 100, 110, 180, and 185. *American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.*

Synco 115—Production of an improved, low-cost, unextended phenolic laminating varnish called Synco 115 is announced in this brochure. Described are the product's properties and the advantages deriving from these properties. *Snyder Chemical Corp., Henry St., Bethel, Conn.*

Casting resins—Laminac casting resins are described in this technical data booklet. In addition to listing characteristics of the thermosetting polyester resins, the booklet de-


Material Manufacturers–
Plastic Compounders–Molders
GET THESE 8 COMBINED ADVANTAGES IN REDS AND YELLOWS FOR COLORING YOUR PLASTIC MATERIAL
CADMOLITH
REDS and YELLOWS
COLORS
Glidden leadership in pigment research offers material manufacturers, compounders of new or old materials, plastic molders, or coaters a combination of advantages found in no other Red or Yellow pigments. These colorants, in Glidden CADMOLITH* Colors make your coloring job easier—give finest, most lasting colors in powders or plastic products made from them.
Specify Glidden CADMOLITH*
Gain these 8 Superior Properties . . .
Soft, and Easy to Grind
Alkali and Acid-Resistant
Non-Fading to Light
Wide Range of Shades
Insoluble in all Vehicles
High Heat Resistance
Non-Bleeding
Opaque
SEND FOR THIS FOLDER giving complete details, with color chips. Write The Glidden Company, Chemical & Pigment Company Division, Union Commerce Building, Cleveland 14, Ohio.
CADMOLITH
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SUNOLITH*
Lithopone
ZOPAQUE*
Titanium Dioxide
TITANOLITH*
Titanated Lithopone
COMPANY DIVISION

scribes numerous uses for the resins by electrical and electronic manufacturers. *American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.*

X-ray fluorescence analysis—Use of high intensity X-ray tubes and high efficiency Geiger counters for nondestructive identification of elements is described and illustrated in this 4-page folder. Of particular interest are two drawings, one of which shows the basic geometry and operating principle; the other is a typical fluorescent chart as semi-automatically recorded for a chrome-nickel plating on a silver-copper base metal. *Research & Control Instruments Div., North American Philips Co., Inc., 750 So. Fulton Ave., Mt. Vernon, N. Y.*

Styrene monomer—The many and varied uses of styrene monomer and the materials made from it are described and illustrated in this 40-page booklet. Included among the styrene derivatives covered are styrene-based dispersions, polyester resins, elastomers, styrene modified alkyd resins, and styrenated oils. One section of the booklet is devoted to the newer and growing commercial applications of the styrene monomer. *Monsanto Chemical Co., Texas Div., Texas City, Texas.*

Extruding machines—Latest models of extruding and vulcanizing equipment for the plastics and rubber extrusion industries are featured in this 12-page illustrated booklet. Complete installations of assemblies for thermoplastic wire insulating and for continuous vulcanizing are described in detail. Also covered are take-up assemblies for wire insulating and the new heating jackets for temperature control. *The Standard Machinery Co., Mystic, Conn.*

Annealing Plexiglas—Information on a recommended annealing technique for molded Plexiglas parts is given in this bulletin No. 130. The data include heating and cooling rates. The causes of crazing are described, as is also the use of the annealing technique as a preventive. *Rohm & Haas Co., Washington Square, Philadelphia 5, Pa.*

Reinforcing resin emulsion—Tackifying and reinforcing resin emul-

sions for both natural and synthetic rubber latex are described in data sheet No. A-42. Included are specific formulations for compounding natural, Neoprene, and GR-S rubber latices. *American Resinous Chemicals Corp., 103 Foster St., Peabody, Mass.*

Engraver—Advantages and uses of an engraver which is easily adaptable to work on plastics are outlined in this 2-color brochure. Several attachments available with the engraver for use in engraving curved surfaces and large instrument panels are described and illustrated with examples of actual work. Also included is a listing of outstanding users of the equipment. *Green Instrument Co., 377 Putnam Ave., Cambridge, Mass.*

Xylonite—The complete story of the development of Xylonite (celluloid) in England is given in this 40-page booklet prepared to commemorate the 75th Anniversary of The Xylonite Group. Early struggles to produce a satisfactory material and to find markets for it are recorded, largely in the form of abstracts from the private journal of the son of one of the earliest workers with cellulose nitrate. From this historical survey the text continues with a recording of more recent events, the financial position of the Group, their functions in research and development, present day facilities, exports, etc. From the original company The Xylonite Group has expanded to a point where it now encompasses seven organizations in the plastics field, producing such diversified materials as xylonite, casein, expanded rubber, etc., and manufacturing these materials into a wide diversity of end products. The text is well illustrated with photographs of historical interest as well as of present day plants and equipment. *The Xylonite Group, No. 9 Conduit St., London W1, England.*

Acrylonitrile—The numerous uses of acrylonitrile in making resin adhesives is described in this booklet. *American Cyanamid Co., Synthetic Organic Chemicals Dept., 30 Rockefeller Plaza, New York 20, N. Y.*

S.P.I. symposium—Papers delivered at the Ninth Annual Conference of the Pacific Coast Section, S.P.I., are

presented in this 114-page booklet. The series of speakers covered five divisions: 1) technical speakers on advertising and merchandising, future fields for vinyl resins, closed mold molding techniques, and improvement of molding quality; 2) plastics in aircraft and guided missiles; 3) transparent enclosure materials for aircraft; 4) plastics tooling applications in aircraft manufacture; and 5) high temperature requirements for molding and laminating materials. Members of the Pacific Coast Chapter of S.P.I. are listed. The booklet is available for $1.00 from *Mr. Leslie Swanson, Catalin Corp., 418 E. Third St., Los Angeles, Calif.*

Structural panels—Resolite translucent structural panels of Fiberglas-reinforced polyester and such accessories as corrugated molding, filler strips, sealing mastic, and flashings are pictured and described in this 12-page catalog. In addition to specifications and other physical characteristics of the material, the catalog offers suggested structural applications with detailed drawings. Tables list the complete range of standard widths and lengths of the sheets and corrugation sizes available. *Resolite Corp., Zelienople, Pa.*

Industrial magnifiers—The optical principles of magnifiers, the basic types of magnifiers, and their care and use are covered in this illustrated 24-page manual (No. I-67). In addition to a magnifier selector chart and glossary, the booklet features instructions for measuring with a magnifier including the magnification and field for view necessary for correct usage. *Bausch & Lomb Optical Co., 558 Bausch St., Rochester 2, N. Y.*

Diphenylacetic acid—Properties and specifications of diphenylacetic acid are listed in this 9-page technical data bulletin, together with a discussion of suggested applications. Also included is a synopsis of investigations in the field, with references. *Kay-Fries Chemicals, Inc., 180 Madison Ave., New York 16, N. Y.*

Hydraulic presses—A 16-page, 2-color bulletin (No. 5204) catalogs the company's line of 9-, 16-, 32-, and 60-oz. hydraulic plastics injection molding machines. All of the machines are illustrated, together with full specifications of each model and photographs of parts typical of those being molded on the machines. Also included are case histories on several installations of the various presses. *Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.*

Index of literature—Presented as an index of technical literature, this 20-page bulletin consists of both a numerical listing and alphabetical cross index for specification sheets, instrumentation data sheets, catalogs, and other literature. Included in the alphabetical index are articles from *Instrumentation*, the manufacturer's quarterly publication. *Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44, Pa.*

Stock plastic parts—Illustrations and descriptions of thirty-six groups of stock plastic knobs, handles, terminal strips, and similar components are included in this 4-page catalog. Certain design variations, such as thread sizes, cored holes, etc., are possible within each grouping. *Dimco-Gray Co., 207 E. 6 St., Dayton, Ohio.*

Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials	Total p'd'n. first 5 mos. 1952	Total sales first 5 mos. 1952
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	4,435,129	4,287,513
0.003 gage and over	3,610,454	3,550,488
All other sheets, rods, and tubes	2,344,969	2,191,275
Molding, extrusion materials	21,908,228	21,530,288
Nitrocellulose:		
Sheets	2,207,889	1,918,980
Rods and tubes	312,053	372,680
Other cellulose plastics[b]	3,650,306	3,262,985
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	25,733,867	17,181,600
Adhesive	16,069,807	14,940,618
Molding and casting materials[a]	69,195,461	59,085,910
Protective coatings (unmodified and modified except by rosin)	11,060,015	9,735,455
Miscellaneous uses	24,784,808	22,752,041
UREA AND MELAMINE RESINS:		
Adhesives	31,253,980	31,235,752
Textile-treating resins	13,698,347	13,090,519
Paper-treating resins	8,560,491	8,481,897
Protected coatings, modified and unmodified	8,706,372	7,210,738
Miscellaneous uses, including laminating and molding[c]	22,061,827	23,315,422
STYRENE RESINS:		
Molding materials[a]	102,344,632	83,708,268
Protective coatings, modified and unmodified	24,987,203	27,082,163
Miscellaneous uses	26,445,774	21,782,245
VINYL RESINS:[d] Total	189,870,436	162,377,498
Sheeting and film (resin content)[e]		64,351,267
Adhesives (resin content)		5,993,320
Textile and paper-treating resins (resin content)[f]		16,603,302
Molding and extrusion materials (resin content)		57,015,069
Protective coatings (resin content)		7,240,690
Miscellaneous uses (resin content)		11,173,850
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	71,730,900	71,833,995
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:		
Molding materials,[a, g]	41,500,556	41,144,758
Protective coatings[h]	28,409,441	28,092,859
All other uses[i]	38,570,772	37,738,826

* Dry basis is designated unless otherwise specified. [a] Includes fillers, plasticizers, and extenders. [b] Includes sheets, rods, and tubes, and molding and extrusion materials. [c] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [d] Production statistics by uses are not representative, as end-use may not be known at the time of manufacture. Therefore, only statistics on total produc-

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS[e] FOR APRIL, 1952, AND MAY, 1952
by U. S. Tariff Commission

April 1952		*May 1952*	
Production	*Sales*	*Production*	*Sales*
585,028	807,031	634,861	735,617
784,952	847,924	758,060	723,894
510,434	554,046	377,463	425,462
4,985,271	5,047,068	4,121,916	4,188,380
449,985	397,071	429,388	326,160
76,595	69,561	55,690	58,154
683,092	760,221	657,474	632,805
5,483,175	3,740,262	4,849,098	3,496,898
3,679,763	3,183,458	2,987,506	3,155,059
10,374,004	12,350,798	11,478,165	10,416,343
1,821,724	1,995,281	1,674,200	1,746,856
4,593,622	4,420,644	4,694,013	4,853,189
6,208,034	6,512,107	6,521,733	6,822,842
2,526,468	2,470,774	2,474,663	2,376,616
1,255,312	1,513,955	1,669,570	2,031,535
1,803,133	1,272,529	1,734,710	1,509,668
4,243,333	4,763,146	4,289,401	4,683,962
19,974,724	18,691,952	19,021,385	16,329,549
5,178,098	5,931,923	5,892,565	6,529,169
4,992,331	4,355,129	4,937,722	5,186,901
35,955,096	32,824,635	31,896,906	29,809,702
	12,484,310		11,992,726
	1,257,383		1,327,264
	3,489,612		3,388,154
	11,993,397		9,289,105
	1,636,716		1,539,425
	1,963,217		2,273,028
14,786,043	14,643,767	14,774,281	15,397,590
8,438,771	8,380,560	9,030,831	9,111,178
2,298,675	1,962,078	2,078,812	2,139,771
8,683,728	7,338,209	8,309,711	8,374,347

tion are given. [e] Prior to January 1951, statistics were given on the basis of total weight. [f] Includes data for spreader and calendering-type resins. [g] Includes data for acrylic, polyethylene, nylon, and others. [h] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [i] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

Safety on the *United States*

THE superliner *United States* which recently broke all speed records, is, in addition to being the fastest ship on the oceans, as safe from fire as man's ingenuity can make her, thanks largely to plastics. Selection of materials for building and decorating the *United States* was a stupendous task. She was designed by naval architects Gibbs and Cox with the actual construction work done in Newport News, Va., by the Newport News Shipbuilding and Dry Dock Co.

There are almost no "fire-proof" materials; anything will burn if the temperature is high enough. However, for all practical purposes, the only things aboard the *United States* which will support combustion are such items as clothing, trunks, and other personal belongings brought aboard the ship by its crew and passengers.

Plastics of all types and kinds aided greatly in making possible interiors which were luxurious enough to satisfy the ship's decorators, Smythe, Urquhart, and Marckwald, and at the same time were fire resistant enough to meet the requirements of the Navy and Coast Guard.

New Decorative Laminate

Westinghouse Electric Corp., Pittsburgh, Pa., after months of experimentation, developed a new decorative Micarta which was used on all of the vessel's hundreds of table tops and other horizontal furniture surfaces. This material is a sandwich composed of an aluminum sheet core with faces of decorative melamine laminate. These faces are bonded to the aluminum with a phenolic resin. Only one laminating operation is required to produce the outer decorative melamine layers and to bond them to the aluminum core. The phenolic bond eliminated difficulties arising from the different expansion rates of aluminum and melamine laminate.

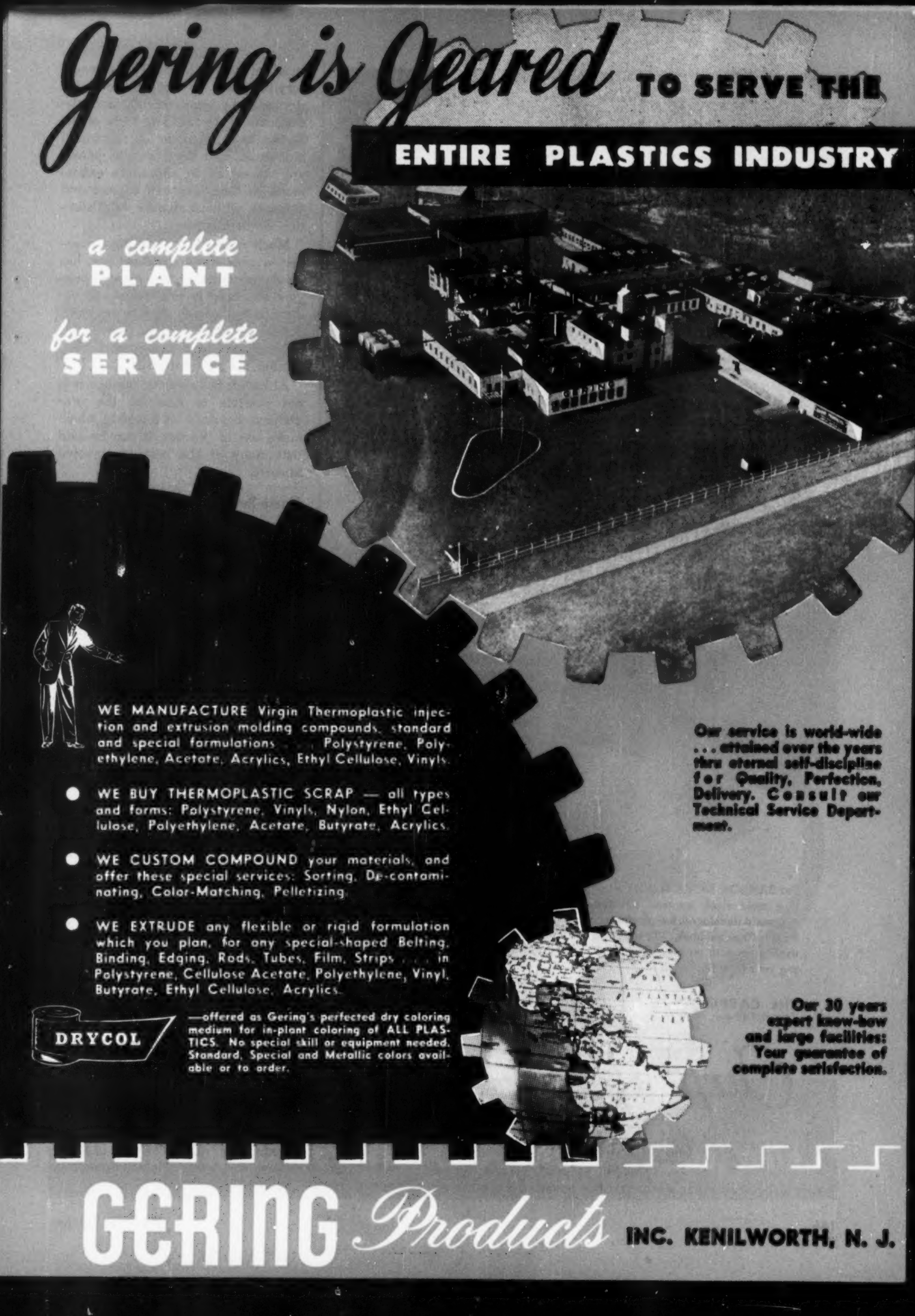
Over 27,000 yd. of fabric woven from Carbide & Carbon Chemical Co.'s new textile fiber, Dynel, were used for draperies, bedspreads, etc. This fabric, woven by J. H. Thorp Co., New York, N.Y., is pleasant to the touch, and will not stretch or sag; however, the prime reason for choosing this material was the fiber's unusual resistance to combustion. Contemporary designs and decorator colors, including six different patterns and 11 different color schemes, were made possible by a new color printing technique applied by Decora Corp., New York, N.Y. In this process, advantage was taken of the fact that one of the resinous constituents of Dynel is of the vinyl family; therefore a special vinyl resin ink which in itself is nonflammable was developed for the printing. One of the major printing problems was controlling the temperature for curing the ink, since too high a temperature would tend to harshen the fabric. Good over-all sun-fastness is achieved by printing the fabric with a light color over the entire background surface, and surprinting the design in the desired colors.

Lamp Shades

The lamp shades in staterooms, public rooms, and corridors are made from a white parchment-textured combination of Fiberglas mat bonded with Vinylite resin. The material was produced by Polyplastex United, Inc., New York, N.Y., and the shades were fabricated by Eastern Art Studios, New York, N.Y. This combination satisfactorily passed the tests for fire resistance, yet the material has a unique decorative quality which compliments the furnishings. The shades are completely washable and light fast and, most important from the standpoint of shipboard use, are resistant to mildew.

The deck chairs on the *United States* are made of aluminum with arm rests of a high-pressure laminate. All the ash trays were either glass or molded from an asbestos-filled phenolic compound.

In addition to the plastics used for decorative purposes, many other applications were made where practically no other material would fulfill all requirements. For example, the ship architects decided to make the crow's nest the first one to be totally enclosed, so that the men on watch would be protected from the elements. Since weight was an important factor throughout the entire ship, it was decided to use transparent acrylic Plexiglas panels here in-


Gering is Geared TO SERVE THE
ENTIRE PLASTICS INDUSTRY
a complete PLANT
for a complete SERVICE
WE MANUFACTURE Virgin Thermoplastic injection and extrusion molding compounds, standard and special formulations . . . Polystyrene, Polyethylene, Acetate, Acrylics, Ethyl Cellulose, Vinyls.
WE BUY THERMOPLASTIC SCRAP — all types and forms: Polystyrene, Vinyls, Nylon, Ethyl Cellulose, Polyethylene, Acetate, Butyrate, Acrylics.
WE CUSTOM COMPOUND your materials, and offer these special services: Sorting, De-contaminating, Color-Matching, Pelletizing.
WE EXTRUDE any flexible or rigid formulation which you plan, for any special-shaped Belting, Binding, Edging, Rods, Tubes, Film, Strips . . . in Polystyrene, Cellulose Acetate, Polyethylene, Vinyl, Butyrate, Ethyl Cellulose, Acrylics.
DRYCOL
—offered as Gering's perfected dry coloring medium for in-plant coloring of ALL PLASTICS. No special skill or equipment needed. Standard, Special and Metallic colors available or to order.
Our service is world-wide . . . attained over the years thru eternal self-discipline for Quality, Perfection, Delivery. Consult our Technical Service Department.
Our 30 years expert know-how and large facilities: Your guarantee of complete satisfaction.
GERING Products INC. KENILWORTH, N. J.

stead of safety glass. The forward acrylic panel is curved to meet streamlining requirements, and the side panels are flat. The body of the crow's nest is made of fabricated aluminum, and the Plexiglas panels are assembled in aluminum extrusions so that they can expand and contract without danger of distortion or breakage.

Much of the ship's wiring, in order to pass Navy specifications, has vinyl insulation. Melamine-Fiberglas was used in the electric power distribution panels as bus supports; the same material forms fuse panels as well as grab and guard rails around the switch boards.

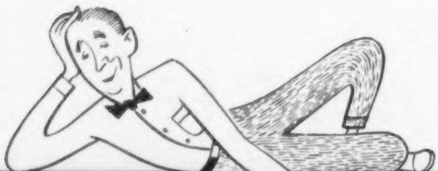
Although for security reasons it is not possible to describe the mechanical bearings on this ship which make use of plastics, it can be said that many of the bearings involve Micarta.

Flame-Resistant Bulkheads

Special Marinite panels produced by Johns-Manville Corp., New York, N.Y., were used throughout the *United States* as bulkheading, ceilings, and linings. Normally, linseed oil is used by Johns-Manville in producing these panels; but for this application, in order to impart maximum flame resistance, Bakelite Corp. furnished a special low-viscosity phenolic resin which was used as a surfacing saturant.

In order to protect the weather decks from corrosion, electrolysis, etc., a special material known as Neotex was furnished by the Cross Products Corp., New York, N.Y. Several coats of this material, based on a neoprene latex, were used on the decks. The resulting surface was then covered with a protective sealer material based on a special vinyl formulation.

The plastics applications described above are a representative cross-section, but they do not by any means cover the complete use of plastics aboard the *United States*. Such well-known items as telephones, switchboards, components of radio, radar, and other navigational instruments are, of course, among the additional shipboard uses of plastics. Suffice it to say that the designers, ship builders, and decorators would have been hard put to produce a ship of such luxury, speed, and safety if plastic materials had not been available.



It's Easy to COLOR Polyethylene

And it's just as easy to save as much as $8.00 per 100 lbs. (more than with any other plastic) if you dry-color polyethylene in your own plant.

No expensive equipment is needed—no special training. All you do is standardize on Ferro Dry Colorants, and the rest is simple.

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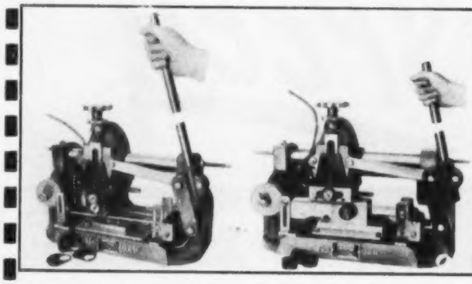

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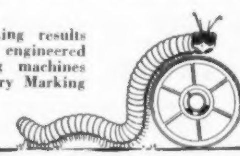

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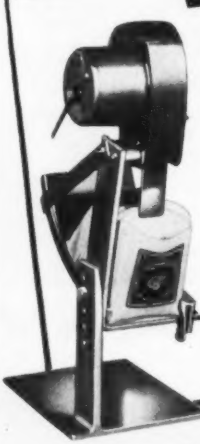

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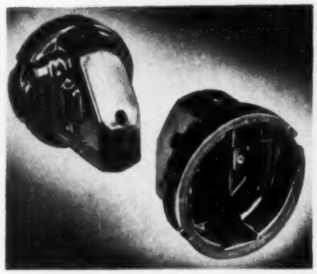


Front and back views of miner's lamp housing molded of high impact phenolic

Miner's Lamp

HIGH impact phenolic is used to mold the housings of a new miner's lamp being distributed by Mine Safety Appliances Co., Pittsburgh, Pa. The material successfully withstands the abuse to which the lamps are subjected; it also resists the acids commonly present in mines.

Thomas A. Edison, Inc., West Orange, N. J., which developed and molds the lamp housing, selected medium high impact phenolic compound RX-428, made by Rogers Corp., Manchester, Conn., for use.

The design of the lamp housing called for dimensional stability and moldability to close tolerances. Electronic preheating was employed which also helped to retain dielectric qualities of the material.

Lamp with phenolic housing is attached to front of miner's protective helmet

Nylon rims resist abrasive action of wire screen and assure accurate count

Nylon Rims

DURABILITY and the excellent wearing qualities of nylon have been put to good use in an abrasion-resistant rim on a Durant counter.

The Durant counter is a device for measuring the length of wire screen to be packaged for shipment in 100 ft. rolls; in such use, its rim is constantly subjected to the abrasive action of the screen. Various kinds of rubber rims, which were used prior to the conversion to nylon, were unable to withstand the wear to which they were exposed and had to be replaced on the average of once every three weeks. Moreover, the fact that even slight wear would throw off the count and prevent proper measurement necessitated keeping a constant check of the wheel diameters.

The nylon rims, made from FM-10001 nylon tubing supplied by the Polymer Corp. of Pa., Reading, Pa., provided the answer to the problem. In contrast to the rubber rims, they have already been in service for more than seven months with no measurable amount of wear, no replacement, nor any contemplated replacement in the near future.

The rim measures 5.73 in. o.d. by $5\frac{11}{16}$ i.d. by ½ in. long. It is press fitted on the wheel which is machined to a diameter 0.010 in. larger than the i.d. of the nylon rim. A straight knurl is also put on the wheel to aid in holding the rim in place.

Machine Cover

A REMOVABLE cover, fabricated from 0.093-in. Boltaron copolymer sheet and designed for use on home washing machines, has been developed and put into production by Durable Formed Products, Inc., New York, N.Y.

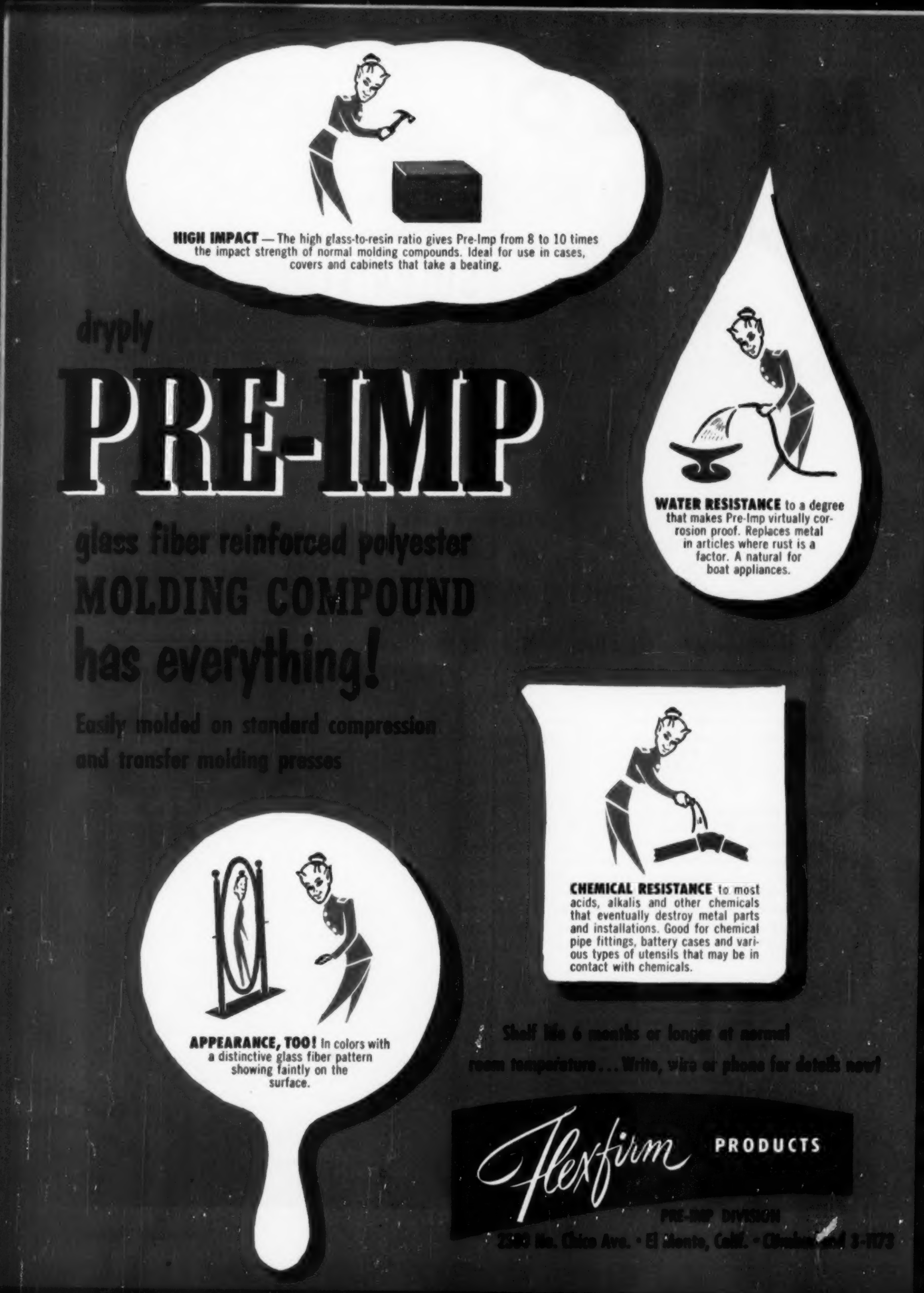
The choice of black copolymer sheet, as produced by Bolta Products Sales, Inc., Lawrence, Mass., for this application was made on the basis of the material's conformance to three major qualifications—that the cover be light in weight, durable, and waterproof.

Primarily, the cover had to be able to withstand the wear and abuse to which it is subject when used on a home washing machine. At the same time, it had to be lightweight for ease of handling, and had to be unaffected by the water, soaps, and other materials to which it would frequently be exposed during household use.

The durability of the copolymer sheet, its high impact resistance, its light weight, and its waterproof and stainproof qualities indicated that it would measure up well to these requirements.

Two additional factors which were instrumental in the choice of the material were its distinctive appearance and the ease with which it can be molded.

Cover for washer made from coplymer sheet is light, durable, and waterproof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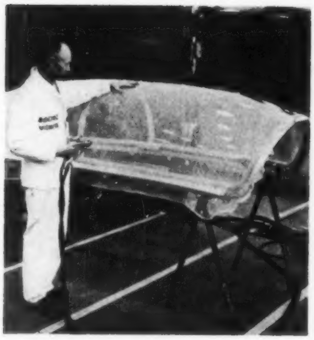


Solution of polyvinyl butyraldehyde is sprayed on plane canopy for protection

Canopy Protection

OPTICAL and aerodynamic qualities of transparent acrylic canopies for B-47 Stratojet planes are preserved at the Boeing Airplane Co., Wichita, Kan., by a plastic protective coating which guards against any possible marking or scratching during factory handling and installation. The coating, Spraylat A, is manufactured by the Spraylat Corp., New York, N.Y., and consists of an emulsion of polyvinyl butyraldehyde in water.

The Spraylat A is sprayed on the canopy by the fabricator as protection while en route to the Boeing plant, where it must be removed to permit the canopy to undergo a series of heat treating operations. When these have been performed, the canopy is cleaned with naphtha and its metal frame masked off. A strip of thin cheese cloth, which is intended to increase the protection afforded by the coating without the need for a costly increase in the coating's thickness, is then draped over the body and four coats of Spraylat A—enough to assure film strength greater than the adhesive strength—are sprayed on. The force of the material coming out of the spray gun attaches the cloth to the canopy, which is now ready to be placed in stock until installation.

Removal of the coating when the final assembly of the airplane is complete is a simple matter of peeling off the cheesecloth, leaving the canopy as smooth and as transparent as when it was first received from the fabricator.

Vinyl Molds

PHENOLIC and polyester parts are being cast in inexpensive vinyl molds at the plant of Applied Resins Corp., Newark, N.J.

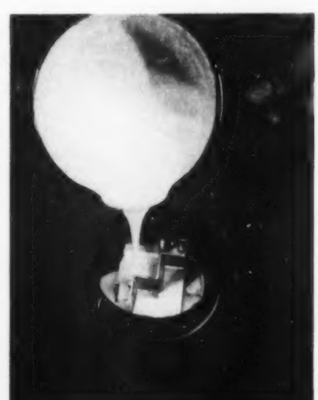
Made from B. F. Goodrich Chemical Co.'s Geon paste resin, the vinyl plastisol molds are used when limited quantities of parts are needed, where elaborate metal molds would involve too great an initial cost. Because of inherent flexibility, these vinyl molds can be drawn in several directions as against the single direction draw of a lead mold. Thus, through the use of these plastisol molds the manufacturer is able to gain a greater versatility in the mold design.

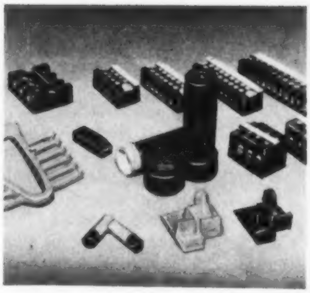
One of these vinyl molds can be used for approximately 50 cast phenolic parts or 10 to 50 polyester parts before breakdown of the mold occurs and it must be discarded.

The first step in making a vinyl plastisol mold is to fashion a positive model from metal. This is placed in a container and the plastisol poured so that it completely covers the metal model. After oven curing, and subsequent cooling, the surplus mold material is cleaned from the underside of the model. The mold is then stripped off and is ready for use.

The casting operation involves simply pouring liquid casting material into the vinyl molds which, in the case of phenolic, are then put into ovens; fusion takes place at a temperature of 150 to 180° F. Liq-

Vinyl plastisol is poured over metal model





Typical cast phenolic and polyester parts made in inexpensive vinyl molds

uid polyester materials, which do not require oven curing, are poured into the mold and cured at room temperature for 1 to 6 hr., depending upon the size and shape of the mold.

Terminal blocks for industrial control and power wiring, internal mountings for hearing aids, remote control switch handles for x-ray machines, relay connecting mounting blocks, and all types of special castings of semi-intricate design which are made of phenolic, polyester, or ethoxyline resins are among the items being cast in flexible vinyl molds.

In the production of plastisol compounds for making flexible molds, the manufacturer has the advantage that expensive equipment is not required to mix the ingredients; in addition, the physical and chemical qualities of the paste resin base can be controlled to meet the rigid specifications required by flexible molds.

Removing metal model from cured mold

Crane Windows

MAKERS of Harnischfeger cranes and excavators have recently installed in their control cabs windows of "CR-39," an allyl diglycol carbonate sheeting. This product of Cast Optical Corp., Riverside, Conn., is said to have optical qualities approaching those of plate glass.

The material is claimed, in addition, to have greater impact resistance, greater abrasion resistance, and to generally outperform any of the other materials tested as to sturdy operating features.

Fabrication of CR-39 windows for Harnischfeger is done by Wisconsin Specialty Glass Co., Milwaukee, Wis. Both cranes and excavators utilize curved panels for maximum visibility and protection. The windows and panels are available in sizes ranging from 36 by 48 in. to 46 by 96 in. and from stock 0.020 to 0.50 in. thickness.

The size to be used in the window is cut down from standard 40 by 60 in. sheet, using a fine-tooth band saw. Cut edges are then sanded. Sheets to be formed are preheated to 230° F. and bent to shape between flannel-covered male and female forms. When cooled, they retain the curvature of the forms.

In mounting the panels in the cabs, a U-shaped rubber channel, similar to that used for mounting safety glass, is used.

Plastic panels in overhead crane cab have good clarity, resist abrasion

On Stage

(*Continued from pp. 94-7*)

of a base layer of heavy vinyl sheet, a layer of aluminum foil, and two layers of vinyl film between which the color is spread. Of more than 500 costumes supplied by Brooks Costume Co., New York, N. Y., for Ringling Brothers Circus this year, 75% are either completely made of Gleam or use it in decorative trim.

Breakaways

Low molecular polystyrene resins are now generally used by Hollywood studios for molding breakaway glass props (Fig. 14). The compounds can be made so brittle as to be practically useless for any other purpose. Special phenolic and arylsulfonamide-formaldehyde compounds have also been developed.

Breakaway windowpanes are cast by pouring the melted compound onto a sheet of cellophane fastened to a wooden frame. The cellophane, acting as a mold-release agent, also shrinks on contact with the heat of the resin and furnishes a taut, smooth surface. More economical breakaway panes sometimes used in television are sheets of cellulose acetate or pieces of acrylic cut and taped together.

Plaster extended with ground Styrofoam is a popular breakaway material for opaque objects.

Special Effects

Flexibility, ease of handling, transparency, and translucence make acetate sheets a good candidate for decorative stage effects. One such application is the birdlike mobile in Fig. 15.

Specialty uses for acrylic primarily utilize the material's clarity and high refractive light index. For instance, fog is simulated on television by blowing chemically produced vapor into a small, perfectly transparent acrylic box placed directly in front of the camera lens. Clarity of the acrylic is so high that the intensity, movement, and color of the vapor-mist can be closely controlled.

Extremely dark transparent acrylic sheets have a special use on TV quiz programs; information to be shown to the audience is placed behind the dark acrylic sheets and, when lighted from behind, becomes

visible to the audience. When the lights are turned off, the panel assumes an opaque appearance.

Future Developments

The variable demands of movie production have made it practical for individual studios to maintain their own shops for fabricating sets and props. Here staff technicians are constantly developing new uses for plastics. Highlights of present applications have been given above, but the demands of the movie industry are by no means satisfied. The studio shops offer a number of challenges to the plastics industry:

Development of thermoplastic materials with better tensile strength for structural purposes.

Improvements in polyester resins, such as more satisfactory fire-resistant types; improved parting agents for flexible molds; further development of spray techniques; and development of a colorless, transparent resin of low shrinkage.

More economical processes for making vinyl plastisol plants.

Acknowledgments

In addition to those companies mentioned in the text, Modern Plastics is indebted to the following for their helpful cooperation in the preparation of this article: Herbert Meyer, Motion Picture Research Council, Inc., Hollywood, Calif.; Arthur Segal, Studio Alliance, Inc., New York, N. Y.; Ben Walters, Ben Walters, Inc., New York; National Broadcasting Co., New York; American Broadcasting Co., New York; Commercial Plastics & Supply Corp., New York; Donald Oenslager, New York; Jo Mielziner, New York; Miles White, New York; Edith Lutyens, New York; Brooks Costume Co., New York; Metropolitan Opera Association, Inc., New York; William Herrschaft, Herrschaft Studios, New York; Ringling Brothers, Barnum & Bailey Circus; Toni Hughes, New York; Messmore & Damon, Inc., New York; American Cyanamid Co., New York; Celanese Corp. of America, New York; The Dow Chemical Co., Midland, Mich.; E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.; B. F. Goodrich Chemical Co., Cleveland, Ohio; Monsanto Chemical Co., Springfield, Mass.; and Rohm & Haas Co., Philadelphia, Pa.

Silicones

(Continued from pp. 73-80)

be doubled in a year or two. Such a development will take it out of the specialty class and give it a tensile strength nearer to GR-S, which has a tread stock strength of about 4000 p.s.i. This does not mean silicone rubber will be used for tires, but the new reinforcement technique plus temperature resistance will make it more satisfactory than other elastomers for gaskets, specialty hose, and seals. Even now, silicone rubber V-belts used in an area subject to high and low temperatures are standing up remarkably well in severe accelerated life tests.

Silicone rubber is sold by both major producers, but General Electric is now selling silicone rubber gum from which processors can make modifications to suit their particular needs.

Among the pioneers in silicone rubber fabrication is the Connecticut Hard Rubber Co., New Haven, Conn., who say that their business in silicone products has doubled every year since they started working on them shortly ofter the war.

Strip Heater

A new product of the company is a specially designed strip heater to perform all sorts of duties. This heating unit, embedded in silicone rubber coated glass fiber, will give 200° F. with the flick of a switch. It can be furnished in strip or pad style and can be simply laid in place, sandwiched in aluminum panels, or cemented to a surface.

The idea of this heater was developed from a device for de-icing the air-intake shut-off doors of the jet engine used on B-36 airplanes. In strip form, it can be wrapped on or placed in any position and cut to any length because the transverse heating elements are connected in parallel. It could be used for show cases, pipes in chemical plants, for warm storage, on storage batteries which lose efficiency as temperature goes down, and for glue joint drying. In reinforced-polyester fabrication, it permits cementing of odd shaped and odd size parts. "This strip heater is a potential million-dollar business," says a company executive.

Another new Connecticut Hard Rubber product is silicone-rubber

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HB-40 is finding wide use in producing vinyl extrusions, vinyl pastes, vinyl slush moldings, vinyl calendering. It is also of special interest as a low-cost plasticizer in polystyrene casting resins, polystyrene adhesives, molding polyvinyl carbazole, strip coatings for metals, floor tile compositions, asphalt base paints.

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sponge that will resist the full silicone temperature range. It is especially valuable for light-weight gasketing in airplanes and is recommended as vibration insulation for instruments. The sponge can also be adhered to glass cloth for strength and for ease in cementing to other surfaces. As a gasket for oven or refrigerator doors, it might be just the ticket.

A silicone-rubber coated glass fabric formed in accordion style for expansion joints has replaced stainless steel bellows in a power plant. The expansion joint is exposed to a temperature of 450° F. at the furnace, and 150° F. at the stack, and must allow for the resultant expansion and contraction. The same principle is involved in molded silicone-rubber joints for de-icing airplane wings where the hot air duct passes from section to section of the plane wing.

Silicone-rubber coated Orlon diaphragms from 1 to 18 in. in diameter are also being produced for gas meters and pressure regulators where high heat is involved. The same material is recommended for inflatable bags used in polyester molding when flexibility, extensibility, and curing at high temperature are involved.

One of the best known uses for silicone rubber is in shock mounts for airplane instruments, where vibration is a problem. Another fairly common use is silicone-rubber coated fabric hot air ducts in airplanes, which replace aluminum, take care of expansion and contraction, and eliminate rattles.

The Garlock Packing Co., Palmyra, N.Y., have also developed some interesting silicone-rubber applications. Among them is a vacuum gasket which is subjected to dry heat and gives off almost no vapor diffusion to cloud or discolor tubes in the associated equipment. Another is a silicone-rubber diaphragm with an asbestos cloth insertion used in a valve to prevent the pumping of too high a pressure in an air reservoir. This air is at high temperature. All other rubber-asbestos diaphragms oxidize and in a comparative test failed at 200,000 to 360,000 cycles. The silicone-rubber asbestos cloth diaphragm operated in excess of 1,000,000 cycles and was still in excellent condition. This same company also produces a weather-proof

gasketing for floodlights from braided asbestos which has been treated with silicone.

Fluids

Silicone fluids are used for so many things that it would take a catalog to list them all. Their inert properties plus non-sticking and all the other things heretofore named make it possible, for example, to use the same type of silicone to cure a bloated cow as well as to stop foaming in such things as crank case oil at high temperatures. It is also used in deterring foam in sugar, wine, and synthetic rubber, among others. If anyone wants to prove its efficacy, just try to work up soap suds on the hands if there is silicone on them.

Low viscosity silicone fluid is being used as a condensing medium for removing moisture from blood plasma. High viscosity fluid is being evaluated as a replacement fluid in the chest following removal of a portion of the lung.

One of the biggest uses for silicone fluid is as a mold release agent, especially for rubber and plastics, where it can take the place of soaps or stearates. The rubber companies use a 35% silicone emulsion diluted with water as a release agent, and have speeded up production by many percent as a result. Plastics molders use a 1 or 2% silicone fluid mixed with solvent, or the emulsion type, when they have a tough undercut job to release, and also claim that it improves the surface of the molding. Silicone fluid is also claimed to be the key to shell molding in the metal casting industry, where a diluted emulsion of silicone gives excellent release of the resin-sand shell mold.

Another application to show the versatility of this fluid is its use to prevent sticking of washers to the metal flanges of couplings on Pullman cars.

Mastic and Grease

National Engineering Products have two unusual silicone compounds. One is a sealing compound for seams. It is a mastic material which will adhere to metallic as well as non-metallic surfaces, and maintain its characteristics over a temperature range from +400 to −65° F. It is especially useful because of this wide range—otherwise, less costly materials could be used. The other is a lubricating grease for pneumatic systems, and as a bearing lubricant. Its feature is that it will control the amount of swell in rubber gaskets, contrary to normal silicone greases, which cause a gasket to shrink.

Polishes containing silicone for autos and furniture made a sensational debut over a year ago. Only 2 to 4% silicone is included in the wax, but the silicone is so good that microcrystalline wax at 40¢ a lb. can be more generally used than carnuba at $1.20 a lb., so the finished product is still low cost. The silicone lubricates the wax crystals and makes them more efficient and easier to apply.

Now the silicone fluids are moving into textiles, especially the synthetics, where they are used as water repellents and retain a spray rating of 100 even after 10 dry cleanings. They are heat set, but require no washing to remove smell or toxicity. A new silicone fluid is being tried as a water repellent for leather in shoes and sporting goods. The idea is to make the leather water proof without affecting its porosity. This

same "hatred for water" makes silicones a useful material for coating fibrous glass used in life preservers and floats of various types.

Vibration Dampers

One application where the unusual retention of viscosity of the silicone fluids over a wide temperature range is of prime importance is in vibration damping. One drop on the needle of an instrument in an aircraft cockpit will hold the needle steady. Silicone has a promising future for suppression of torsional vibration in auto crankshafts. One torsional damper consists of a circular inertial mass which floats on a 10 to 20 mil film of silicone fluid contained in a casing attached to the end of the crankshaft. It is used for in-line engines only, is not necessary in V-type. Any fluid might work, but it would have to have a high viscosity that does not change at any temperature.

Another silicone fluid is used to impregnate glass fabric ironing board covers that are scorch-resistant, allow fast evaporation of steam, and are waterproof.

As an indication of the variety of uses for silicones of different types in one product, it is estimated that from 50 to several hundred pounds of the materials go into each military airplane produced.

Tremendous Future

In the foregoing pages, we have pointed out some of the highlights in the progress of the silicone industry. The story as told here is by no means complete. But we believe that enough has been recorded to indicate that silicones, which are not much more than 5 years old in real, practical application, are on their way to a tremendous future.

Evidently the producers feel the same way. Dow-Corning has announced that it will invest over $13 million in plant expansion, which is the third and largest expansion since initial plant construction in 1944. General Electric Co.'s Chemical Div., the other major producer, has also announced an expansion program of $5 million. It is significant that the silicone business is so diverse and different that each organization has set up an independent silicone branch of the parent company.

Another company, Linde Air Prod-

ucts Co., Div. of Union Carbide and Carbon Corp., has just received approval for a $751,000 Certificate of Necessity, which is 60% of the amount applied for. Linde has had a silicone water repellent for masonry on the market for several years, and is welcoming inquiries regarding all types of silicones.

Vinyl Silicone

However, the company is particularly interested in a new type, vinyl silicone, which is free of chlorine and is a neutral hydrocarbon-soluble polymer. It is a reactive material with organic and inorganic materials, and can be polymerized with such materials as butadiene-styrene.

Vinyl silicone is believed to be particularly useful in polyester-fibrous glass moldings and sheet materials, because it improves the wet strength when the glass cloth is first treated with the silicone resin. Polyester glass has a high dry strength of 60 to 65,000 p.s.i., but may drop to 40,000 when wet. Vinyl silicone is said to give the wet material 95% of its dry strength. The vinyl silicone also closes the voids around the glass and prevents wicking, thus improving moisture absorption properties. For serving trays, boat structures, shower stalls, etc., this use should be most helpful.

Improved clarity can also be obtained from this better wetting of the fiber by vinyl silicone. Samples have shown that printing can be read through a vinyl silicone treated polyester-glass laminate. If completely wetted, the laminate would be almost as clear as glass.

For Defense

The big upsurge in silicone expansion has no doubt been influenced by the Defense Program. Estimates say that all the way from 60 to 80% of present silicone production is directly or indirectly going to military items. Sales were down somewhat in the early months of this year, but not as much as other plastics, but military purchases for silicone were on the decline due to the stretch-out program. There seems little doubt that this emergency program has stimulated silicone production beyond the slower and more normal pace of peace-time operations.

Nearly everyone in the industry expects silicone volume to increase, but the chances for rapid growth without military stimulant are questionable. Slow growth is more likely, especially in the electrical field.

In the first place, cost is a deterrent. Silicone resin for laminates cost $19 or $20 a gal., but contain a lot of solvent. The fluids which are 100% silicone cost around $35 a gallon. Silicone rubber is $3.20 to $4.00 a lb. — 4 or 5 times the cost of Neoprene, the next highest cost elastomer. Increased production will eventually help to reduce the cost, but the material is essentially expensive. The same basic raw material is used for all four types of compounds, but the processing method for each is different, and the four production line facilities are not inter-changeable. It is possible that a great demand for fluids, for example, might help reduce the price for that type, but wouldn't help the laminating resins because they are made on a different production line. Therefore it is probable that silicone plastic resins will have to continue to be sold for jobs where their proved lower maintenance cost or high heat resistance is the controlling factor.—END

Acrylics

(Continued from pp. 81-3)

largely on the type of application and length of run.

While the dies for forming are lower in cost than molds for injection, the material for forming, whether cast or extruded, is more expensive than injection molding material. All the other elements—labor costs, speed of production, optical requirements, freedom from strain—are involved.

An interesting example for comparison is found in display buckets, vacuum formed from Plexiglas by Bassons Industries Corp., Bronx, N.Y. This job is made from cast acrylic in a six-cavity die, and is done to close enough tolerances for the purpose. Fair uniformity of wall thickness was obtained by means of pattern heating (described in the previous two articles in this series) and careful use of pressure, along with a slip-ring to permit the edge of the material to move slightly in the forming process. A single cavity mold for injection molding this unit would cost a great deal more than the six-cavity dies used for forming. In this case, the run was such that vacuum forming paid off.

Big jobs like the 8 ft. diameter Shell trade mark beacon fabricated by Steiner Plastics Mfg. Co. Inc., Glen Cove, N.Y., out of Plexiglas, are the type in which injection molding could never compete with sheet forming. Incidentally, Steiner is now making a similar sign 13 ft. in diameter.

Between the extremes of piece size and length of run lies a big field of battle between vacuum forming and molding of acrylics. And another field of battle is between formed cast material and formed extruded material. New improvements in ovens, better vacuum controls, more accurate engineering, will keep a good balance of business in the hands of the fabricators.

Finally, a whole new field of operation is opening to fabricators in the very thin extruded acrylic sheet materials, now being offered by such companies as Joseph Davis Plastics Co., Arlington, N.J., and Plax Corp., Hartford, Conn. These thin acrylics will be subject to processing on the new automatic forming machine.—END

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ACRYLIC FORMING AND FABRICATING. Booklet lists and illustrates the facilities of, and type of products which can be made from formed and fabricated acrylics by Plastic Age Co. **(I-202)**

"KEL-F" DISPERSIONS. Technical bulletin on properties, and application information about two non-aqueous dispersions of "Kel-F" (trifluorochloroethylene polymer) for coating various surfaces. The M. W. Kellogg Co. **(I-203)**

"MINIJECTOR" INJECTION MOLDING MACHINE. Specification and price data on a ¾-oz., hand-operated injection molding machine with interchangeable cylinders and heating units. Moslo Machinery Co. **(I-204)**

FOAM PLASTISOL. Technical report describes the properties and uses of a recently developed foam plastisol, from which expanded sheeting and coatings may be produced. Sample included. Interchemical Corp. **(I-205)**

ETHOXYLINE RESINS. Description of "Araldite" ethoxyline resins which harden practically without evolution of water or volatile matter to form corrosion-resistant adhesives for metals, ceramics, and other materials. Ciba Co., Inc. **(I-206)**

COLORING CELLULOSE ACETATE. Folder points out the advantages of having the individual molder color his own cellulose acetate and cellulose acetate butyrate and explains the techniques for obtaining good dispersion. Ferro Corp. **(I-207)**

UTILITY ENGRAVER. Booklet on the "Panto" heavy-duty bench-type engraver for engraving plastics, metal, etc. Contains type samples and illustrations of supplementary equipment. H. P. Preis Engraving Machine Co. **(I-208)**

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"PLIOVIC AO" ORGANOSOLS. Techni-Guide tells about compounding and processing "Plicvic AO" organosols. Gives details on plasticizers, solvents, fillers, coloring, and formulations. The Goodyear Tire & Rubber Co. **(I-216)**

MOLDING FACILITIES. Injection and compression machines, mold making facilities, and typical products manufactured are enumerated in a folder issued by Plastimold Corp. **(I-217)**

GLASS FABRICS FOR MOLDING AND LAMINATING. Descriptions and characteristics of "Textiglass" extra thin cloth of continuous filament glass yarn, unilateral strength cloth, deep drawing quality cloth and extra heavy glass cloth are contained in a folder issued by Madagascar Graphite & Mica Co. **(I-218)**

NEOLYN RESINS. Data on group of resins which can be used with film-formers and with vinyl chloride polymers and copolymers for use in lacquers, adhesives, organosols, and plastics. Hercules Powder Co. **(I-219)**

AUTOMATIC COMPRESSION MOLDING MACHINES. Bulletin on Baker fully automatic compression molding machines for high speed molding of small and medium size parts from phenolic, alkyd, urea, "Teflon," and other plastic materials. Baker Brothers, Inc. **(I-220)**

"FLEXOL" PLASTICIZER CC-55. Technical information bulletin on a primary plasticizer for the vinyl chloride resins which shows good compatability with many coating resins and polymers. Carbide and Carbon Chemicals Co., Div. of Union Carbide and Carbon Corp. **(I-221)**

"LUCOFLEX" RIGID POLYVINYL CHLORIDE. Booklet explains how the superior mechanical, electrical, and chemically resistant characteristics of "Lucoflex" rigid vinyl suit it to a wide range of industrial applications. Data on fabrication. American Lucoflex, Inc. **(I-222)**

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"BOLTARON" MOLDING MATERIAL. Leaflet explains the characteristics of "Boltaron", a thermosetting material of almost unlimited formability and high impact resistance. Bolta Products Sales Inc. **(I-224)**

NYLON COATING OF WIRE. Booklet discusses the methods and equipment required for the application of nylon coatings in the manufacture of electric conductors. Details on coating methods and takeups. Industrial Ovens, Inc. **(I-225)**

"EXON" VINYL RESINS. Data on "Exon" resins, a series of polymers and copolymers of vinyl chloride, having a wide range of applications. Gives test procedure for determining characteristics. Firestone Plastics Co. **(I-226)**

DUREZ PLASTICS NEWS. Latest issue of this house organ illustrates and describes some current applications of the various grades of Durez phenolic resins. Durez Plastics & Chemicals, Inc. **(I-227)**

"STYROFOAM." Technical data on the mechanical, thermal, electrical, and other properties of "Styrofoam" expanded polystyrene for insulation, buoyancy, and display applications. Information on finishing methods. The Dow Chemical Co. **(I-228)**

LABELING IDEAS. Brochure contains hundreds of suggestions on sizes and styles of labels for packaging and shipping. Ever Ready Label Corp. **(I-229)**

"STAFLEX KA." Description of a plasticizer which is designed to incorporate some of the advantages of the high-molecular-weight polymerics without their disadvantages. Deecy Products Co. **(I-230)**

PLASTICS FOR DEFENSE AND INDUSTRY. Brochure explains facilities available for injection and compression molding, mold making, fabricating, and allied operations. Michigan Molded Plastics, Inc. **(I-231)**

LAMINATED "INSUROK." Data sheet containing electrical, physical, and hot punching characteristics of a paper base laminated phenolic with applications in the television and electronics industry. The Richardson Co. **(I-232)**

GLASS-REINFORCED ALKYD. Magazine reprint discusses the characteristics and uses of the high impact strength material obtained by blending glass reinforcement with alkyd. Plaskon Div. Libbey-Owens-Ford Glass Co. **(I-233)**

"CHEMELEC" ELECTRONIC PRODUCTS. Data sheets on electronic products and other industrial parts which this company makes with "Teflon" and "Kel-F" fluorocarbon materials. United States Gasket Co. **(I-234)**

STYRENE MODIFIED NATURAL OILS. Technical data report on the effect of adding styrene monomer to drying oils in surface coatings to obtain alkali resistance, good color, and similar improved characteristics. Monsanto Chemical Co. **(I-235)**

"REZ-N-GLUE." Data on the new size 3-oz. tube of this vinyl base cement for adhering plastics to plastics and to non-plastics. Schwartz Chemical Co., Inc. **(I-236)**

M. P. C. FACILITIES. Booklet explains the facilities available for custom compression molding and other supplementary activities at Molded Products Corp. **(I-237)**

GRANULATING MACHINES. Facts regarding the Cumberland plastics granulating machines, designed expressly for plastics. Capacity, uses, advantages, etc. Cumberland Engineering Co., Inc. **(I-238)**

LABORATORY PRESS. Applications, improved features, and accessories for general research are covered in booklet on the Carver laboratory press. Prices and specifications included. Fred S. Carver, Inc. **(I-239)**

CUSTOM MOLDING FACILITIES. Booklet briefly describes the facilities, equipment, personnel, and history of Worcester Molded Plastics Co. **(I-240)**

PRINTING MACHINES. Catalog describes various hand-operated, semi-automatic, and automatic machines for printing, decorating, etching, gold stamping, roller coating, and dipping plastic items of all sizes. Apex Machine Manufacturing Co. **(I-241)**

"SOLKA-FLOC" FOR RUBBER. Bulletin tells how "Solka-Floc" finely divided wood cellulose fibers can be used as a filler material for rubber. Charts show typical effects on properties. Brown Co. **(I-242)**

VINYL ACETATE POLYMERS AND COPOLYMERS. Folder describes various polyvinyl acetate emulsions, solutions, and copolymer materials which are available on a custom compounded basis for heat-seal, solvent reactive, decorative and other coatings, and for use as adhesives. National Starch Products Inc. **(I-243)**

FABRICATING "LUCOFLEX." Bulletin explains uses and advantages of pipes, ducts, and other structures fabricated of "Lucoflex," chemically resistant, unplasticized polyvinyl chloride. The Van Dorn Iron Works Co. **(I-244)**

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Plasticizers

(*Continued from pp. 84-86*)

of the grand total, but showed a 219% increase over 1950 production. The reported DIOP production in 1950 was undoubtedly low. Substitution of DIOP and the acrylic phosphoric acid esters for DOP may explain part of the decrease in DOP percentage of the grand total. Production of the miscellaneous cyclic plasticizers increased 45 percent.

A further examination of Table III will show the details of the other changes that occurred during 1951. New requirements for low-temperature properties were reflected in the 20 to 25% increase for the various adipates and sebacates. Particular mention should be made of the 89% increase in acyclic phosphoric esters such as TOF, S-140, and S-141.

PVC Plasticizer Estimate

Last year's MODERN PLASTICS article on the growth of plasticizers volume (October 1951, p. 106) gave an estimate for plasticizers consumed by the polyvinyl chloride and copolymer industry. Another attempt at this type of segregation is made in Table IV, p. 86. These figures were obtained by talking with men in the industry and are indicative of current trends. The properties and uses of these various plasticizers were described in last year's article and hence are not included in this present article.

Plasticizer Raw Materials

New plasticizer raw materials or expansion of present raw material supplies were spurred by the high demand during 1951. Enjay's production of isooctyl alcohol has been increased several fold and the production of 2-ethyl hexyl alcohol has been expanded. Gulf Oil Co. and Standard Oil Co. of Indiana have announced their entry into oxoalcohol production, particularly isooctyl alcohol, during the next year. Nonyl alcohol is also available again for ester manufacture. An octyldecyl alcohol mixture from the reduction of coconut fatty acids is being used in the manufacture of plasticizers. Capryl alcohol is available at low cost and in sizeable quantities as a by-product from the manufacture of sebacic acid from

castor oil. Decyl alcohol, a new oxo-process alcohol of special interest, is being manufactured by Enjay. A high quality isobutyl alcohol is being produced by Tennessee Eastman Co.

Previously, the supply of dibasic acids has been a limiting factor in the production of plasticizers. Production of the standard dibasic acids as well as newer organic acids has been expanded. Phthalic anhydride production is being increased considerably; terephthalic and isophthalic are being offered for plasticizer use; sebacic acid production has been increased; and Du Pont's adipic acid is more readily available for plasticizer manufacture. Azelaic and pelargonic acid production is being expanded at Emery Industries, by the installation of a new and unique ozone oxidation process. A recent announcement from the Naval Stores Div. of the USDA on pinic acid from the oxidation of turpentine has been of interest particularly in the manufacture of diesters for synthetic lubricants. Mixed dibasic acids, suitable for plasticizer manufacture, have been announced by C. P. Hall. Aconitic acid, a by-product from sugar manufacture, is being investigated by plasticizer producers. Other companies are working on oxidation processes which may lead to special acids that may be used for plasticizer manufacture.

Production Capacity

Plasticizer production capacity is being increased with Monsanto's plant which is located in Everett, Mass., Barrett's Frankfort, Pa., plant, and the Pittsburgh Coke & Chemical Co.'s new plasticizer plant which is situated at Neville Island, Pittsburgh, Pa.

Some indication of the production facilities which are available for plasticizers may be obtained from the following list of present producers of the materials:

American Cyanamid Co.
Arnold, Hoffman & Co.
Baker Castor Oil Co.
Barrett Div., Allied Chemical & Dye Corp.
Cabot, G. L., Inc.
Carbide and Carbon Chemical Co.
Celanese Corp. of America
Commercial Solvents Corp.
Deecy Products Co.
Dewey and Almy Chemical Co.

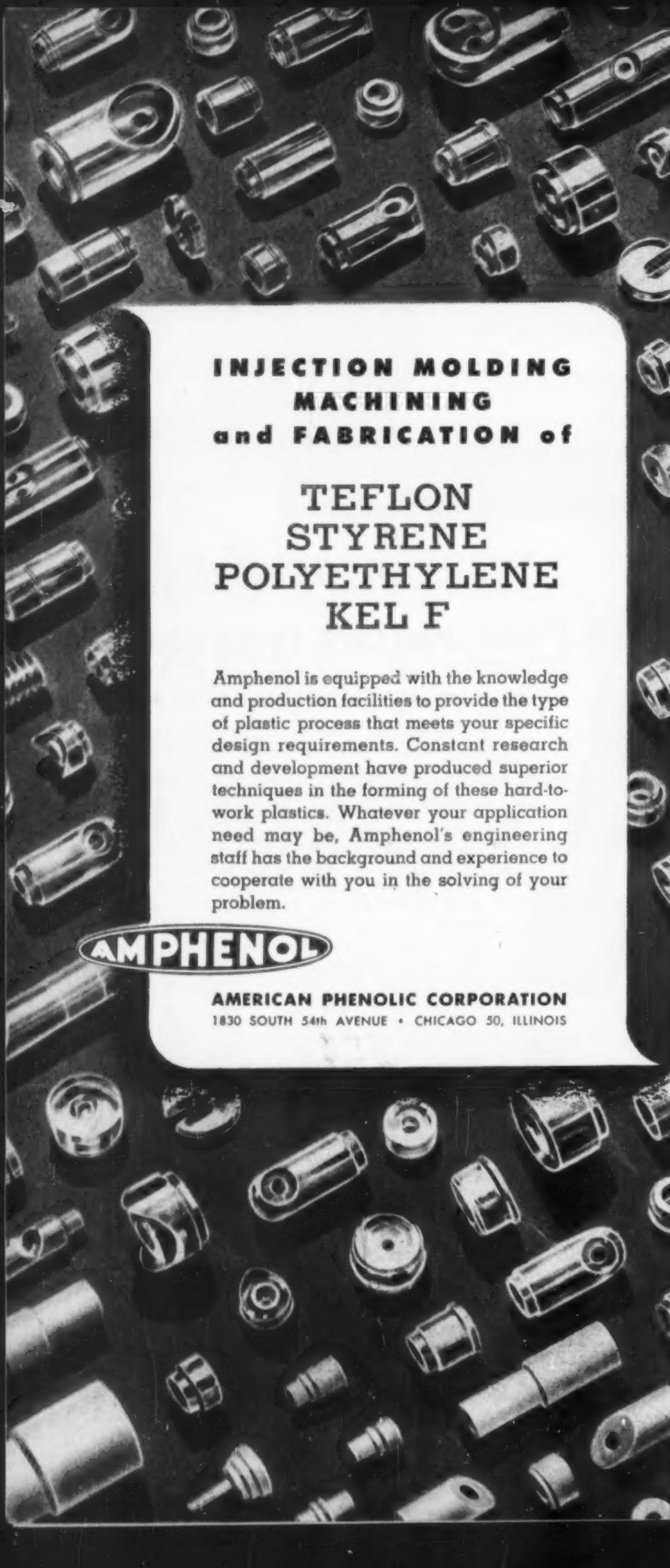
Drew, E. F., Inc.
E. I. du Pont de Nemours and Co., Inc.
Emery Industries, Inc.
Goodrich Chemical Co.
Hardesty Chemical Co.
Hercules Powder Co.
Kessco Chemical Corp.
Monsanto Chemical Corp.
Montrose Chemical Co.
Morton-Withers Chemical Co.
Ohio-Apex, Inc.
Pfizer, Charles, & Co.
Pittsburgh Coke & Chemical Co.
Rohm & Haas Co.
Rubber Corp. of America
Tennessee Eastman Co.

New Developments

There have been a number of new plasticizer developments during the last year, and the tendency is to tailor new plasticizers to specific applications. In the past, some plasticizers were based on by-products or simple combinations of available raw materials, but the trend is toward the development of new and special plasticizers for specific end-uses. Low temperature properties, permanence, and low cost are among the important factors which are considered.

Carbide and Carbon's Flexol CC-55, a hexahydrophthalate, was offered in 1951 and provides good low temperature properties and a relatively low viscosity. Rohm & Haas have S-38, which is a low cost plasticizer with good permanence, and S-71 which offers stabilization with good low temperature properties. Dinonyl phthalate and dinonyl adipate are being offered by Pittsburgh Coke & Chemical Co. These two plasticizers, of high purity, have extremely low odor. Deecy Products Co. is selling a nonyl plasticizer, dinonyl sebacate, and a polymeric under the trade name Staflex KA. Plasticizer 100, a phthalate made from an alcohol cut having an average chain length of ten carbons, is being offered by Tennessee Eastman as a less volatile plasticizer than DOP.

That company has also developed diisobutyl phthalate, which is cheaper than di-n-butyl phthalate and reportedly imparts better low temperature properties to nitrocellulose lacquers. Cabot has a new didecyl phthalate which has been recently announced, as well as an improved dicapryl phthalate. Har-



desty's Harflex 500 offers excellent low temperature properties at medium price, and their dibenzyl phthalate is being offered more extensively for electrical insulation applications.

Barrett Division's Elastex 50-B, a secondary plasticizer with good processing characteristics, has been reduced considerably in price in comparison to its initial price. Hooker's MPS-500 (methyl pentachlorastearate) offers good performance and imparts flame resistance. Ohio-Apex's new KP-504 bis-(di-methyl benzyl) carbonate is a medium priced plasticizer with good electrical properties. The plasticizers mentioned above are merely representative of the development activity that is going on at the present time in this ever-expanding industry.

Future of Plasticizers

Vinyl products today are accepted so readily that it is hard for many to realize that this industry is relatively new. The standard uses of vinyl materials in peace-time are well known, and the importance of vinyl resins in war-time has been described by J. R. Hoover, president, B. F. Goodrich Chemical Co., as "key materials for national defense, fully comparable in their essentiality to the synthetic rubbers." New applications for vinyl plastics are continually being discovered, and the industry is spending millions of dollars each year to develop vinyls with new and better properties. The development of improved plasticizers is an important part of this program.

More and more manufacturers are discovering that the use of plastics not only cuts their manufacturing costs appreciably, but also enables them to make products that are more colorful, lighter in weight, and often more durable than products made of the materials they have replaced.

As discovered in the past, there are many problems to be solved in applying vinyl resins to such diverse uses as floor tile, toys, and rainwear. However, with large potential markets awaiting development and with the growth momentum described here, this industry should continue its expansion, and the markets for plasticizers are expected to expand with it.—END

Insulating

(Continued from page 122)

placed in the conditioning cells, before the fungus spores were allowed to grow. Fig. 2 (page 129) shows the effect of moisture on material 5 manifested a few minutes after the samples are put into a 100% relative humidity chamber, long before fungi had time to grow on the plastics.

Of all the materials studied, the laminated plastics, often those of good electrical grade, were found to have shown the most extensive deterioration in electrical properties (Figs. 3-8, inclusive; to be found on pages 122 and 202). The molded thermosetting plastics showed less

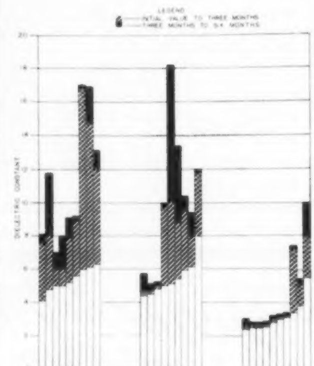
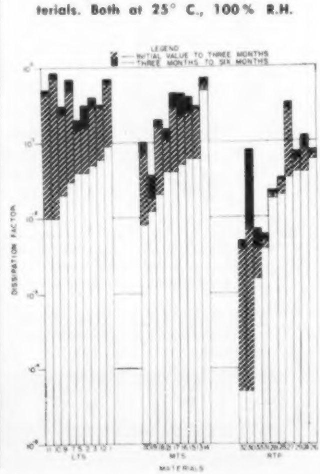


Fig. 7 (above)—Dielectric constant at 1 m.c. of test samples; Fig. 8 (below)—Dissipation factor at 1 m.c. of materials. Both at 25° C., 100% R.H.



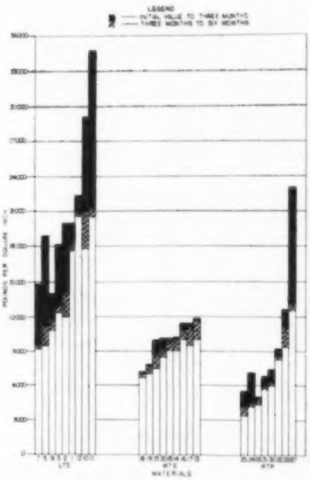


Fig. 9—Flexure flatwise of test specimens at 25° C., 100% R.H.

evidence of deterioration than the laminates and the rigid thermoplastics, the least of all. When laminates are cut, they have extensive exposed areas of water-absorbing filler materials; the molded materials, on the other hand, have fillers which are in a fine state of subdivision and completely surrounded by resin. For either case, the resin and the filler form a heterogeneous composition, the properties of which are dependent on the mutual effects of the constituents. The effect of moisture on the rigid thermoplastics is dependent solely on the water absorption of the polymerized resin.

In the mechanical tests, the effect of moisture was also found to be significant, but in an unusual way (Figs. 9 and 10). There is a decrease in the flatwise flexural strength and an increase in the Izod flatwise impact strength of the plastics, the latter effect being due to the plasticizing action of water on the polymerized resin.

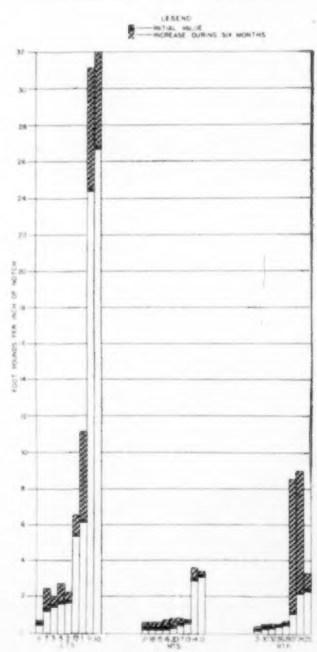
The same general effects were found in the edgewise flexure and edgewise impact tests, which were run on the laminated thermosetting plastics only. Tensile and compressive properties of most of these materials were found to be related to their flexural strengths, since in flexure both the tensile and compressive stresses are present. The flexure test was used because of the ease of specimen preparation.

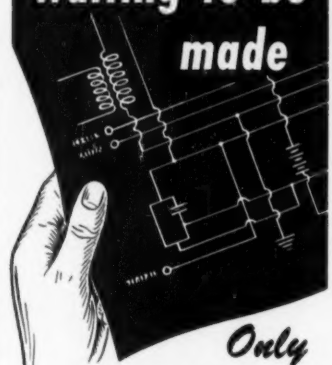
All of the illustrative information in this article was chosen from the data measured at 100% R.H. It is part of a three volume report covering 85%, 95%, and 100% relative humidities, in which individual graphs illustrating each material and each property under two conditions and the three relative humidities were compiled.

Acknowledgment

In June, 1945 the National Defense Research Committee initiated an extensive program at the Johns Hopkins University in the Plastics Laboratory, to study the effect of moisture and fungus on the electrical and mechanical properties of plastic insulating materials. In November 1945, this project was placed under the direct supervision of the Air Materiel Command at Wright Field, Ohio, until its completion in November, 1947. Through the cooperation and permission of the Department of the Air Force, this comprehensive report is being made public for the first time, and is a contribution of the Johns Hopkins University, Institute for Cooperative Research.—END

Fig. 10—Impact flatwise of test specimens at 25° C., 100% R.H.





Heating

(Continued from pp. 124-30)

tions of heat conduction. From the equations of heat conduction it was determined that the heating ability curves could be used for different materials by multiplying the production rate for a standard material by a constant factor depending on the thermal constants of the material. For the purpose of comparing various materials Styron 666 clear was used as a reference and the multiplying factors for the other materials shown in Table II were based on this standard. The standard curve for Styron 666 clear used in Fig. 5 was obtained experimentally and the curves for the other materials were calculated from the constants given in Table II. The curves of Styron 475 and Ethocel have been checked experimentally with good agreement.

Test Method

The following method could be used in measuring and comparing the heating chambers of injection molding machines.

1) All injection molding machines would be rated in terms of a certain molding material. Sloane[3] has proposed that the material formulation and color sold in the largest quantity in 1951 be used as a standard. Other materials could be related to this reference material by factors similar to those shown in Table II.

2) The mass average temperature would be measured with the string thermocouple nozzle described previously, for various production rates.

3) The heating efficiency would then be calculated from the formula

$$E = \frac{T_a - T_o}{T_1 - T_o}$$

where T_a is the mass average temperature, T_1 is the control temperature, and T_o is the initial polymer temperature. This heating efficiency is then plotted against the production rate in lb. per hour.

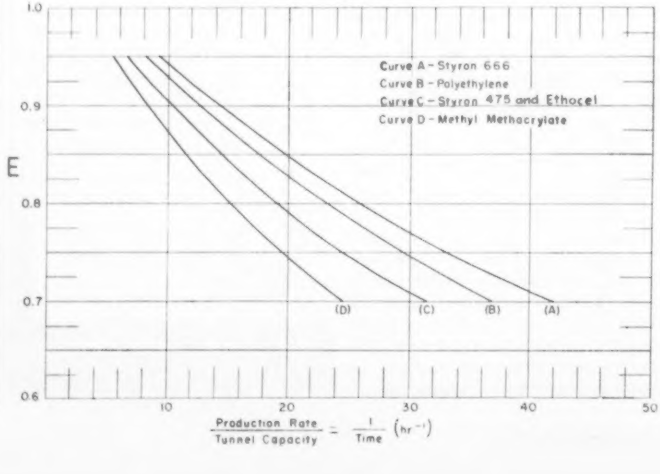
4) An average value of heating efficiency that will give good moldings in the majority of molding jobs can be determined and the production rate of an injection molding machine can be given at this value of heating efficiency. Since this is not the maximum output of the machine it should be given another name, such as "heating chamber rating."

5) When these heating efficiency curves are available on a large majority of the types of molding machines in use, these data could then be collected and an average heating ability curve calculated and supplied to the molders and manufacturers for comparison with present and proposed heating chamber designs.

Table II—Heating Efficiency Factors for Various Molding Materials

Material	*Multiplying Factor*
Styron 666 clear	1.00
Styron 475 natural	0.74
Ethocel	0.73
Polyethylene	0.89
Polymethyl methacrylate	0.59
Cellulose acetate butyrate	0.69

Fig. 5—Heating ability of molding materials



THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Expansion Program

GOVERNMENT grants of Certificate of Necessity from June 6 to July 17, 1952, to companies who make raw materials for the plastics industry, served to emphasize the enormous capacity being built up to produce plastics raw materials. Certificates granted during that period brought to public view for the first time the enormity of plans being made, especially for polyethylene, polyvinyl chloride and polystyrene.

In an adjoining column will be found the names of various companies involved in this plastics raw materials program, together with other Certificates granted during the June 6 to July 17 period to companies who are involved in the plastics program in other ways. The amount of money involved in these expansion programs is shown here but caution should be used in trying to figure out the capacity of a plant from the dollar investment as shown in this table. The figure could be very misleading. The amount shown here with each Certificate authorization is only that part of the company's proposed expenditure that fell within the Government's emergency expansion program. In most cases, the Government only allows a certain percentage of the proposed expenditure to be amortized for more rapid tax adjustment. Thus, a company may apply for a $10 million expansion for vinyl (as an example) but be allowed rapid tax amortization on only 45% of that amount. In other words, the Government reasons that the company would expand vinyl production anyhow, but encourages the firm to expand 45% more on the theory that 45% more would be needed in the event of an all-out war. The figure in the last column of the table indicates what percentage of the amount applied for as shown in column three has been granted rapid amortization.

In addition, even the total amount shown in the table is no positive indication of plant size because it may mean simply expansion of present plant facilities or it may include cost of the ground, drainage, power plant, administration building, and other costs in addition to the actual production plant.

Polyethylene: The tremendous expansion of high molecular weight polyethylene is quickly exposed in the listings here and those printed in previous months. Carbide and Carbon Chemical Co. has now announced three new plants—one each in Texas City, Texas, Los Angeles, Calif., and Seadrift, Texas. Each will

Certificates of Necessity

Company	*Product*	*Amount Certified*	*% Allowed*
New Jersey Wood Finishing Co.			
Middlesex County, N. J.	Silicone resin coated fiberglass for military end items	$ 35,042	65
Swedlow Plastics Co.			
Youngstown, Ohio	Acrylic products for aircraft	3,435	60
Los Angeles, Calif.	Acrylic products for aircraft		
Hardesty Chemical Co., Inc.			
Dover, Ohio	Sebacic acid	539,000	80
Snyder Chemical Corp.			
Bethel, Conn.	Phenolic resins	77,000	45
The Garlock Packing Co.			
Palmyra, N.Y.	Mechanical seals and packings for military end items	160,460	50
Palmyra, N.Y.	Packings and gaskets for military end items	72,374	60
Palmyra, N.Y.	Specialty components for military end items	809,733	65
Catalin Corp. of America			
Fords, N.J.	Phenol resins	300,000	45
Fords, N.J.	Styrene	628,210	45
Firestone Tire & Rubber Co.			
Pottstown, Pa.	Butadiene and butylene	961,500	60
Pottstown, Pa.	Vinyl resins	6,022,700	45
Rohm & Haas Co.			
Philadelphia, Pa.	Sebacic acid	238,835	80
General Grinding Wheel Corp.			
Philadelphia, Pa.	Resinoid abrasive grinding wheels	19,019	65
The Quaker Oats Co.			
Memphis, Tenn.	Furfuryl alcohol	546,250	50
The Dow Chemical Co.			
Midland, Mich.	Butadiene	136,400	60
Freeport, Texas	Ethylene	4,827,000	50
Freeport, Texas	Butadiene	3,480,000	60
Allyn's Point, Conn.	Vinyl resins	9,982,000	45
Midland, Mich.	Styrene	3,250,000	60
Midland, Mich.	Vinyl resins	4,387,000	45
Midland, Mich.	Vinyl resins	5,920,000	45
Freeport, Texas	Styrene	9,400,000	60
Freeport, Texas	Water transportation of chemicals	250,000	45
Freeport, Texas	Vinyl resins	5,930,000	50
Allyn's Point, Conn.	Styrene	3,314,500	45
Torrance, Calif.	Styrene	1,723,000	45
Northwest Plastics, Inc.			
St. Paul, Minn.	Plastic molders	36,724	45
Rilco Laminated Products, Inc.			
Independence, Kan.	Laminated wood cross arms	22,058	60
Union Carbide and Carbon Corp.			
Seadrift, Texas	Polyethylene and ethylene oxide	66,300,474	50
Carbide and Carbon Chemicals Co. Div., Texas City, Texas	Butadiene	893,300	60
Los Angeles County, Calif.	Polyethylene	36,323,000	60
Kanawha County, W. Va.	Styrene	1,081,700	60
Texas City, Texas	Vinyl resins	13,837,000	45
Marietta, Ohio	Styrene	2,722,000	45
Linde Air Products Co., Tonawanda, N.Y.	Silane and silicone products	751,000	60
Foster Grant Co., Inc.			
Port Arthur, Texas	Styrene monomer	4,284,450	60
U.S. Propellers, Inc.			
Pasadena, Calif.	Laminated wooden arches	29,622	60
Timber Structures, Inc.			
Portland, Ore.	Glued laminated wood for military end items	329,670	60
Shawinigan Resins Corp.			
Springfield, Mass.	Vinyl resins	33,000	45
Springfield, Mass.	Vinyl resins	100,350	45

(Continued on p. 208)

* Reg. U. S. Pat. Office.

VISIBILITY by Swedlow in the F-94C Starfire
Pioneer all-rocket Air Force fighter-interceptor, the Lockheed
STARFIRE rises with phenomenal speed to the 45,000 foot bomber attack level.
Its all-electronic radar equipment enables it to lock
fire with devastating effect. The perfect optical properties
transparent enclosures help to make the F-94C a day or night fighting instrument
of scientific precision to protect our country from attack by enemy
Swedlow
PLASTICS CO.

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Certificates of Necessity (Continued)

Company	Product	Amount Certified	% Allowed
Springfield, Mass.	Vinyl resins	919,600	45
Monsanto Chemical Co., Plastics Div.			
Springfield, Mass.	Vinyl resins	92,000	45
Springfield, Mass.	Styrene	87,565	45
Springfield, Mass.	Synthetic resins	500,000	35
Springfield, Mass.	Styrene	157,915	45
Addyston, Ohio	Styrene	3,673,270	45
Long Beach, Calif.	Styrene	133,120	45
Texas City, Texas	Vinyl resins	1,681,250	45
American Monomer Corp.			
Leominster, Mass.	Vinyl resins	160,500	45
National Starch Products, Inc.			
Plainfield, N.J.	Vinyl resins	253,475	45
Pennsylvania Industrial Chemical Corp.			
Jefferson, Pa.	Styrene	3,807,650	50
Continental-Diamond Fibre Co.			
Newark, Del.	Laminated plastics	71,718	45
Pathfinder Chemical Corp.			
Point Pleasant, W. Va.	Styrene	11,496,320	60
Point Pleasant, W. Va.	Polystyrene resins	2,397,650	45
Goodyear Tire & Rubber Co.			
Akron, Ohio	Styrene	1,762,000	45
U.S. Rubber Co.			
Painesville, Ohio	Vinyl resins	3,297,725	45
The General Tire & Rubber Co.			
Calvert City, Ky.	Vinyl resins	5,319,000	45
B. F. Goodrich Chemical Co.			
Calvert City, Ky.	Vinyl resins	5,871,100	45
Dewey & Almy Chemical Co.			
Cedar Rapids, Iowa	Plastic packaging film	1,732,000	50
Texas Eastman Co.			
Harrison, Texas	Synthetic hard wax	3,800,000	50
Diamond Alkali Co.			
Houston, Texas	Vinyl resins	2,526,000	45
U.S. Plywood Corp.			
Portland, Ore.	Phenolic resins	56,985	45
American Cyanamid Co.			
Wallingford, Conn.	Melamine resins	77,963	45
Willow Island, W. Va.	Melamine	615,000	45
Wallingford, Conn.	Melamine resins	803,161	45
Willow Island, W. Va.	Melamine	2,474,000	45
General Electric Co.			
Schenectady, N.Y.	Teflon coated magnet wire	54,200	60
American Phenolic Corp.			
Chicago, Ill.	Aircraft parts	334,144	65
Shasta Plywood, Inc.			
Anderson, Calif.	Hardboard	1,789,420	40
Central Hardboard, Inc.			
Southerlin, Ore.	Hardboard	867,153	40
Cascades Plywood Corp.			
Lebanon, Ore.	Hardboard	871,221	40
Celanese Corp. of America			
Cumberland, Md.	Plastic sheet and film	545,000	45
Rezolin, Inc.			
Los Angeles, Calif.	Plastic tools for defense	75,000	40
Hercules Powder Co.			
Parlin, N.J.	Cellulose acetate flake	2,024,179	45
Parlin, N.J.	Molding powder for military end items	409,412	45
Parlin, N.J.	Chemical products	1,420,000	40
Hopewell, Va.	Ethyl cellulose	315,865	45
Hopewell, Va.	Nitro cellulose	535,000	55
Hopewell, Va.	Nitrocellulose products	781,260	55
Strux Corp.			
Lindenhurst, N.Y.	Cellulose acetate for military end items	123,168	60
Durez Plastics & Chemicals, Inc.			
North Tonawanda, N.Y.	Phenolic resins	3,346,700	45
Haveg Corp.			
Marshallton, Del.	Chemical and acid resistant equipment	98,650	65
Koppers Co., Inc.			
Follansbee, W. Va.	Naphthalene	363,000	50

have an announced capacity of 50 million lb. a year. Together with present capacity, it is estimated that by mid-1955 Carbide will have capacity for well over 200 million lb. annually. The trade estimates that the proposed new Texas-Eastman plant will have a capacity of from 20 to 25 million lb. a year. The Du Pont Certificates for new polyethylene capacity have not yet been issued, but they will certainly be substantial. It would not be surprising if total polyethylene capacity of these three companies reaches between 320 and 380 million lb. in 1955. In addition, there will be considerable poundage of low molecular weight polyethylene for use in waxes, ink, and possibly for some coating jobs.

How much farther polyethylene will go after that is anyone's guess. The basic patents expire in 1956 and it is believed that several petroleum companies who have been working on the project for some time will be ready to enter the field then or perhaps sooner. There are many observers who believe that polyethylene volume will be larger than any other plastic by 1960.

Carbide's new plants at Los Angeles and Seadrift are not exclusively for polyethylene. The Seadrift plant will produce large quantities of ethylene oxide, among other things. The trade is somewhat concerned over all this potential production of ethylene oxide, despite its various uses. It is part of one method for production of acrylonitrile which Carbide uses in Dynel, and acrylonitrile is headed for big things in the textile industry. However, there are indications that a great portion of the acrylonitrile to be produced will be by a method other than the ethylene oxide route.

Another outlet for ethylene oxide is ethylene glycol, a base for antifreeze. Carbide has announced that ethylene glycol will be produced at a 5 or 10 million gal. a year rate at its new Los Angeles plant, and will thus consume part of the Seadrift plant production of ethylene oxide. That oxide can also be used for some of the new soil conditioners, detergents, weed killers, insecticides, and in a plasticizer used for the plastic layer in safety glass. The trade still thinks, however, that Carbide may have something else up its sleeve to account for this big ex-

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pansion in ethylene oxide; all present uses combined are not large enough to account for the announced expansion.

Vinyl expansion: Certificates granted for increased vinyl facilities are especially large. Counting today's known capacity, it is estimated that the newly announced plans will bring total capacity for vinyl chloride to between 800 and 900 million lb. by mid-1955. Some people say that will mean over-production and there has been some grumbling about the Government's OK for such a huge program. Dow Chemical is a big factor in this proposed expansion, with a rather large portion assigned to its Connecticut plant. As a producer of both chlorine and ethylene, Dow has long been regarded as a potentially important factor in vinyl chloride and has finally made the leap. Dow has been producing monomer for several years on a modest scale. Apparently that company has decided to not only expand in the monomer field but to produce polymer as well. It has also announced expansion of vinylidene chloride (saran) production at Midland.

Polyvinyl acetate and alcohol: Shawinigan Resins Corp. has received Certificates for polyvinyl acetate and alcohol production. Polyvinyl acetate has recently aroused wide attention because of several new potential uses which are still under cover. The material also used in the production of polyvinyl alcohol, another resin that is attracting increased interest, and Certificates to produce it have been granted to National Starch and American Monomer as well as to Shawinigan.

Styrene: As predicted in this magazine last January, several new names have moved into the styrene scene. Among them is Pathfinder Chemical, an affiliate of Goodyear Tire & Rubber. Goodyear has been a big user of styrene, was severely handicapped by inability to obtain supplies during the shortage, and is determined not to be so affected in the future. Catalin, Foster-Grant, and Pennsylvania Industrial Chemical Corp. are other newcomers in the styrene field. It is estimated that total production of polystyrene in 1955 will be somewhere between 800 and 900 thousand lb. if all present plans are carried out.

Wood treatment: The table also includes several companies which have obtained Certificates for hardboard, wood treatments, etc., because of the growing importance of this industry to resin producers. Some officials predict that hardboard, for example, will grow tremendously and take over for plywood if the latter should be curtailed because of a shortage of peeler logs. The trend toward greater use of resins with wood seems unmistakable and inevitable. The hint of this development in these Certificate Listings is pertinent at this time.

Vinyl for Guns

THE Springfield Armory, Springfield, Mass., is working on the development of vinyl plastics that might be used for coating gun stocks and for magazine caps, but the materials that have so far been submitted are not satisfactory. At the Armory a vinyl plastisol has been developed which, used as a molding compound, has been injection molded as a magazine cap. Considerable experimental work has also been done on vinyl plastisol compounds for coating metal gun stocks.

We are calling attention to this work because the need for satisfactory material for such uses is urgent. One of the principal problems has been that of adhesion of vinyls to metal. Even the best two-coat adhesives, while reasonably strong, have not shown the desirable adhesion over large surfaces.

Another problem is how to apply the plastisols in the coating processes. Armory technicians would like to have a more rapid and convenient method of application to metal surfaces, including possibilities of field use.

Some of the properties for vinyl compounds that would suit their purposes are as follows: not brittle at -70° F.; dimensional stability at 160° F. for 70 hr.; heat aging resistance that would withstand 70 hr. exposure at 160° F.; a durometer hardness of about 60; extreme oil resistance; and maximum blocking resistance.

Laminating Service

ESTABLISHMENT of new facilities in the South has been announced by Cotswold Fibres, Inc., Columbus, Ga., for extrusion and lamination of polyethylene, saran, and nylon film to woven glass, woven saran, cotton cloth and scrim, paper, aluminum foil, and paper board.

Some of the advantages claimed for these products is that the sheets so treated are rendered vapor- and water-proof, anti-corrosive, grease proof, chemically inert, and heat sealable. In addition, they have flexibility at -65° F., higher tear resistance, increased strength, resistance to all solvents, sun, and weather, and are electrically insulated. Some of the uses to which these products have already been put include government barrier paper and foil, Air Force fibrous glass, reinforced plastic structures, woven glass insulation tape, auto tarpaulin covering, vapor- and water-proof bags and pouches, high grade packaging assemblies, multi-wall paper bag lining, grease-proof bakery plate products, deep freeze coated paper, and drum and carton liners.

Plastics Selector

SELECTION of the best plastic material for any particular application is facilitated by the use of a disk-shaped gadget designed by American Insulator Corp., New Freedom, Pa. Called the AICO Applicator, the selector gives the complete physical properties of the fifteen most widely used plastics. By designating the desired property on the dial of the instrument, the Applicator automatically shows the three best plastics materials for that purpose, and numbered in order of desirability. It also shows the molding method with best results for the finished product.

SPE Contest

THE Fifth Annual National SPE Prize Paper Contest has been announced by J. H. DuBois, Mycalex Corp. of America, contest chairman. The contest is sponsored each year by the Society of Plastics Engineers, Inc., to encourage plastics technicians to prepare technical papers on various phases of the plastics industry.

In addition to prizes offered by the

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local sections of the Society, national prizes are $200, $100, $50, and the presentation of the papers by the authors at the Annual Technical Conference at the Hotel Statler, Boston, Mass., Jan. 21-23, 1953.

Judges assisting Mr. DuBois in the contest are: A. J. Warner, Federal Telecommunication Laboratories, Inc.; Frank Reinhart, National Bureau of Standards; R. L. Whann, North American Aviation, Inc.; and Carmen R. Giannotta, Eastman Kodak Co.

Papers must be submitted to the nearest local section not later than Nov. 1, 1952. Complete contest rules will be furnished by the Society of Plastics Engineers, Inc., 409 Security Bank Bldg., Athens, Ohio.

Polyethylene Containers

A NEW line of unbreakable polyethylene stock and custom bottles and jars for colognes, lotions, and other liquids or creams has been announced by Trina, Inc., 50 Alleppo St., Providence, R. I. Plax Corp. furnishes the squeezable containers.

The line is available in the following sizes: 1-, 2-, and 3-oz. jars; 2- and 4-oz. custom bottles; 2-, 3-, and 5-oz. Taper Round bottles decorated in hearts-and-flowers and gold filigree design; and 2-, 4-, and 6-oz. Oblong bottles.

Vinyl Acetate Resin

DEVELOPMENT of a modified water soluble vinyl acetate resin, Polymer C-3, is announced by Monsanto Chemical Co. R. C. Evans, general sales manager of the Plastics Div., described the new resin as "normally insoluble but becoming soluble on addition of a very small amount of alkali or ammonia." Films cast from ammonical solutions of this new resin become water resistant on drying at room temperature.

The resins are unusually stable at elevated temperatures for hot melt adhesive and coating applications where they can be compounded with plasticizers and extenders in the same manner as unmodified polyvinyl acetate.

"Experiments have proved," Mr. Evans reports, "that Polymer C-3 is an excellent thickening agent and emulsifier for synthetic polymer and copolymer dispersions. Other advantages include its use as a replacement, completely or partially, for polyvinyl alcohol in some applications, as an active surface tension depressant even in hard water, and the fact that the ammonium salt upon drying in air is no longer water soluble." Mr. Evans also suggests applications in coatings, adhesives, and as a binder in paints and printing inks.

Three viscosity grades, V-10, V-20, and V-30, are available. The low-viscosity V-10 is recommended where rapid solubility of the polymer is required. V-30 is tougher and more heat resistant. The product is manufactured in water-white, bead form.

Laboratory samples and commercial quantities may be obtained by contacting the production development department of Monsanto's Plastics Division.

Wall Tile Cutter

SUITABLE for triming plastic wall tile is a new cutter available through S & W Moulding Co., Columbus, Ohio, producer of Miraplas wall tile. The base of this lever-operated tile cutter is notched to fit standard sizes of Miraplas wall tile. Notches keep the tile from slipping when the slicer is lowered. The cutter is rented or loaned by Miraplas dealers to customers installing Miraplas in their homes.

Plaster Cast Material

WELCOME news to people suffering from bone fractures, dislocations, curvature of the spine, or congenital bone abnormalities requiring casts is the development of a new cast composition by Davis & Geck, Inc., a unit of American Cyanamid Co. The material is a melamine powder called Melmac Orthopedic Composition, and it has been described by orthopedic surgeons as the most important advance in orthopedic cast techniques in ten years.

Strength of casts made with Melmac Orthopedic Composition is so much greater that the casts can be as light as one-third the weight of conventional casts. Even though the casts are thinner, they still provide adequate immobility and support within a few hours after application. In addition, thinness of the cast permits greater x-ray penetration and makes continued observation of the patient's progress easier and more accurate. The casts are porous enough to permit evaporation of moisture from the skin.

Nuclear Energy Harnessed

USE of nuclear gaging equipment to insure uniform quality and reduce scrappage on calendering and coating lines is announced by Textileather Co., Toledo, Ohio. According to company officials, an accurate and continuous check of the amount of plastic being formed into sheets or applied to fabric can be secured through the use of AccuRay beta gages which utilize the radioisotope strontium-90. Developed and manufactured by Industrial Nucleonics Corp., 1205 Chesapeake Ave., Columbus, Ohio, the gages weigh the moving material with invisible beta rays and instantly present the information in lb. per sq. yd. on a chart recorder for operating personnel to observe.

To give simultaneous readings of each side of the sheet, pairs of the AccuRay gages are mounted opposite each other, high on the calendering train before the wind-up rolls. The weight of both edges of the sheet is penned on a single chart recorder. Blue ink is used for the right side gage and red ink for the left gage. Object of the calender operator is to see that the traces overlap on the chart, indicating that the sheet is uniform in weight and that the calender rolls are even.

A Century and a Half

ON July 19, 1802, Eleuthere Irenee du Pont de Nemours established a black powder mill on the Brandywine River near the present site of Wilmington, Del. In this year, 1952, the company is observing its 150th birthday. Since the day of black powder to this, Du Pont has expanded operations to 71 plants, 38 research and development laboratories, and 1200 different products of which the latest are Dacron polyester fiber and Mylar polyester film. The company has not only expanded from production of black powder in 1812 to atom bombs (for the Government) in 1952, but has been a leader

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in development of such peace-time products as paint, Neoprene, dyes, nylon, polyethylene, and other materials of every-day importance. About half of the company's products today were unknown 20 years ago.

The best and briefest way to show the importance and progress of Du Pont is to give a brief chronology of some of the company's most important developmental work in the following fields, with particular emphasis on synthetics:

1802—Founded.

1804—First powder sold.

1880—Nitroglycerin and dynamite started.

1894—Smokeless powder.

1902—Built one of first industrial laboratories in the United States.

1904—Company's first departure from explosives when they began producing special type of nitrocellulose for lacquers.

1910—Pyroxylin or nitrocellulose coated fabrics.

1917—Duco pyroxylin lacquers which revolutionized automobile and furniture finishes; first unit for dyes which involved expenditure of $43 million before earnings offset losses but freed U. S. from dependence on German dyes.

1920—Rayon.

1924—Cellophane.

1927—Moistureproof cellophane; launched fundamental research program to uncover basic facts without regard for specific commercial objectives.

1931—Neoprene.

1938—Nylon.

1938-1952—Acrylics; photographic, movie, and x-ray film; polyvinyl butyral film for safety glass; polyethylene; Orlon; Dacron; Teflon; Mylar; titanium; water and flame repellants for fabric; Hanford, Wash., and Savannah River atomic energy projects.

Another Growth Pattern

SOME idea of the expansion going on in the chemical industry, particularly for those companies involved in plastics, can be gleaned from The Dow Chemical Co.'s prospectus which was issued just before their recent sale of $100 million worth of Convertible Debentures. Although Dow may be expanding in a greater ratio than other companies in the industry, their pattern of growth is not dissimilar from most other chemical companies which produce plastics raw materials, with size of company, of course, always a limiting factor.

During the past five fiscal years, Dow and its subsidiaries have expended the following amounts for purchase or construction of capital additions:

1947—$84,000,000
1948— 49,000,000
1949— 43,000,000
1950— 29,000,000
1951— 91,000,000
1952 (estimated)—145,000,000

In each of the next two fiscal years, the company expects to spend $100,000,000. They have already constructed, or intend to construct, facilities worth $265,000,000 for defense emergencies under Certificates of Necessity granted by DPA.

Dow sales volume has grown from $78 million in 1942 to $340 million in 1951. Profits increased from $17 million to $93 million in the same period. Plastics accounted for 29% of the dollar volume of sales in the fiscal year ended May 31, 1952. Magnesium was 11%; industrial chemicals, 52%.

Reinforced Glass Fiber Tubing

LIGHT-WEIGHT, corrosion-resistant thermosetting plastic and glass fiber-reinforced tubing, known as Reflin, is being offered by Reflin Co., 8525 Higuera, Culver City, Calif. With a strength-weight ratio said to be unequalled by any commercial material, Reflin tubing is suggested for use in underground conduits; fuel, natural gas, irrigation, or sanitary lines; shipboard piping systems; and housings for airborne equipment and components. A brochure of engineering information is available from the company.

Textured Upholstery

ROUGH tweed-textured pattern is the latest addition to the Masland Duran line of vinyl upholstery manufactured by Masland Duraleather Co., Philadelphia, Pa. Designed for Masland by the Borgers of Modes & Fabrics, the new super-embossed pattern, called Duratweed, is available in six colors—red, gray, green, ivory, yellow, and chartreuse.

The company also announced that Masland Duran is now available to manufacturers either with or without fabric back. The choice is made possible by the development of upholstery grade quality 3085, designed specifically for manufacturers who want a fabric-backed covering with the pliancy and cleanability of Masland Duran. Quality 3085 is available in the following patterns in their respective color lines—perennial, Kid Handcraft, Embassy, and Duratweed.

Polyester Plasticizer

ANNOUNCEMENT of a new polyester resin plasticizer, called L-894, has been made by Bonner Chemicals, Inc., 31 Spruce St., Leominster, Mass. Films plasticized with L-894 exhibit high gloss, flexibility, and tensile strength. The plasticizer has a wide range of solubilities, including alcohol and hydrocarbons; its compatabilities include cellulose esters, ethers, chlorinated hydrocarbons, and some of the vinyl copolymers.

The manufacturer suggests that the new resin will interest the technical coating trade as well as manufacturers of aircraft finishes and industrial lacquers in general.

Coating for Toys

DEVELOPMENT of Toy Gloss, a fast-drying coating which combines extremely high gloss and good adhesion, has been announced by Bee Chemical Co., 13799 S. Avenue O, Chicago, Ill. The coating comes in two varieties—Series T-11 for styrene toys and Series A-14 for acetate toys—and is available in a full range of standard colors, including gold and silver.

According to laboratory tests, both series will withstand the Scotch Tape test without peeling, will not become brittle with age, will not chip, and can be sprayed under a wide range of pressures.

EXPANSION

Barrett Div., Allied Chemical & Dye Corp., has opened a new laboratory at Edgewater, N. J., for the development and testing of materials

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and processes used in the manufacture of plastics, rubber products, paints and varnishes, paper, laminates, and insulating materials. The new facilities, known as **Shadyside Applications Research Laboratory,** is under the direction of **D. A. Rankin.**

Steiner Plastics Mfg. Co., Inc., Pratt Oval, Glen Cove, N. Y., is adding an additional 10,000 sq. ft. to its factory.

Plax Corp., Hartford, Conn., has started construction of a new plant in Louisville, Ky. The new facilities, the company's first in the Midwest, are expected to be in production of polyethylene sheet, tubing, and bottles by the end of this year.

Leslie Co., Lyndhurst, N. J., has added additional engineering space to its plant. The company manufactures pressure and temperature regulators and controllers.

COMPANY NOTES

Kaybee Corp., 350 Fifth Ave., New York, N. Y., has recently been formed with **Arthur Blumenthal** as president. The new organization has been licensed by **Comprehensive Fabrics, Inc.,** national distributors of **B. F. Goodrich** Koroseal flexible vinyl material, to use Koroseal in manufacturing a line of kitchen accessory ensembles and other household items. Mr. Blumenthal was formerly associated with **Plastron, Inc.** and served as vice president and general manager.

American Cyanamid Co. has appointed **J. D. McPherson** as sales supervisor of the Organic Acids and Plasticizers Dept. of the Industrial Chemicals Div.

The Dow Chemical Co. has named **Parham Industries, Inc.,** Detroit, Mich., as distributor in that area for Styrofoam. The company also announces that **Denis J. Mullins** has joined the New York plastics molding powders sales force.

Goodyear Tire & Rubber Co. announces the establishment of a Films, Foam, and Flooring Div.—which will coordinate development, production, and sales of these products—with **Joseph E. Mayl** as general manager. Departments involved in the reorganization are Airfoam Sales, Vinylfilm Sales, Pliofilm Sales, Flooring Sales, Airfoam and Pliofilm Production, Airfoam Development, Vinyl Production, and Vinyl, Pliofilm, and Flooring Development.

The General Industries Co. Elyria, Ohio, has made the following personnel changes in its Plastics Div.; **Orlo W. Marsh** is vice president and manager; **William E. Foster** is executive assistant manager.

The Fellows Gear Shaper Co., Springfield, Vt., has named **George H. Sanborn** as sales manager, and **Henry B. Flinn** as publicity manager.

The Fiberite Corp., Winona, Minn., has appointed **West Coast Plastics, Inc.,** 4113 W. Jefferson Ave., Los Angeles, Calif., as exclusive representative for the sale of Fiberite high impact molding compounds in the California area.

Jackson & Church Co., Saginaw, Mich., has appointed **James W. Hendry** as director of plastics research and **Boyd W. Bullock** as manager of the plastics division.

Tumble-Buff Laboratories, Inc., has moved to larger quarters at 151-06 Beaver Rd., Jamaica 33, N. Y.

Erie Resistor Corp., Erie, Pa., has set up the following territorial divisions in the sales staff for its Electronics and Plastics Div.: **S. W. Duncan,** Michigan; **John Kilfoil,** Indiana and Southern Ohio; **W. Neelon,** New York State; **J. B. Loeffler,** Chicago; **W. Brosman,** Philadelphia; and **D. A. Leet,** Erie.

Plastic Art Toy Corp. of America, P. O. Box 275, Rutherford, N. J., has been acquired by a group from the plastics industry. New officers of the company are **Joseph A. Jackovics,** president; **Lazzaro A. Fattori, Jr.** and **John Licsko,** vice presidents; **Lazzaro Fattori, Sr.,** treasurer; **Vaughn D. Buckley,** secretary and sales manager; and **Dr. Anthony La Forgia,** assistant treasurer. The company will continue under its own name, but its operation and control will be in the hands of the new management.

R. S. Aries & Associates has set up a regional office at 211 Brightwood Pl., San Antonio, Texas, under **Alden H. Waitt,** vice president.

National Bureau of Standards announces the following appointments through **Dr. Gordon M. Kline,** chief of the Organic and Fibrous Materials Div.: **Dr. Irl C. Schoonover** has been named chief of Polymer Structure Section and will continue as assistant chief of the Organic and Fibrous Materials Div. and acting chief of the Dental Research Section; and **Frank W. Reinhart** has been appointed as chief of the Organic Plastics Section. Mr. Reinhart was formerly assistant chief of that section and joined the staff of NBS in 1937.

Planet Plating Co., Inc., has moved to larger quarters at 494 Morgan Ave., Brooklyn, N. Y.

Wheelco Instruments Div., Barber-Colman Co., has transferred its manufacturing and operating facilities to Rockford, Ill. No changes have been made in Wheelco district offices.

Minneapolis-Honeywell Regulator Co. has named the following industrial sales managers: **Jack E. MacConville,** Atlanta; **Alfred J. McCullough,** Cleveland; **Howard L. Marston,** Minneapolis; **Robert L. Mallory,** Dallas; **Robert B. Grant,** Los Angeles; and **Lester W. Williams,** Portland, Ore., **John A. Robinson** has been named to service the Eastern and Mid-Atlantic regions.

Laminex Corp., Fall River, Mass., has appointed **Process Associates,** West Englewood, N. J., as selling agent for its line of Fiberglas-reinforced plastic resin trucks, tanks, and tubs to the food, chemical, and drug fields.

U. S. Rubber Co. has appointed **Rubber Fabrics Co.,** New York City, as distributor of its cast vinyl film laminated to knitted fabric which will be marketed under the trade name of Vinonit. The material is in production at the recently purchased Stoughton, Wis., plant.

California Reinforced Plastics Co., Oakland, Calif., has appointed the newly formed **Hexcel Products Co.** tive for its products. **Roger C. Steele** as sales and engineering representa- is manager of the new firm; **Theo-**

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dore P. Pajak is eastern representative with headquarters at 6719 Danville Ave., Baltimore, Md.; **Andrew C. Marshall** is southwest representative with offices at 1025 W. Arbor Vitae, Inglewood, Calif. **John J. Foster**, formerly national general sales representative for California Reinforced Plastics Co., will hold the same position in the new company with offices at 19666 S. Harbor Blvd., Santa Ana, Calif.

California Reinforced Plastics Co. has also announced the purchase of a 20,000 sq. ft. building at 951 61 St., Oakland, Calif., which will house the manufacturing facilities of the firm, producer of Hexcel honeycomb in aluminum and glass fabric for the aircraft industry.

General Electric Co. has made the following personnel changes: **Donald A. Hilliard** is supervisor of quality control for the Chemical Div.'s alkyd resin plant at Schenectady, N. Y.; **Dr. Robert H. Krieble** is manager of engineering for the chemical materials department of the Chemical Div.; and **George M. Yesse** has been named manager of facilities engineering for the same division.

Monsanto Chemical Co. announces the following appointments in the Plastics Div.: **Charles W. Roberts**, manager of a newly created sales service department; **Theodore S. Lawton, Jr.**, sales manager for the Vuepak and sheet departments; **Walter Sokolofsky**, foundry service engineer.

Boonton Molding Co., Boonton, N. J., has elected **Frederick K. Davidson** as senior vice president to head research and development and has appointed **Roger M. Daugherty** as general manager of operations. Mr. Davidson, who has been with the firm for 28 years, is widely recognized in the plastics industry for introducing new methods of manufacture and new uses of plastics.

Carbide and Carbon Chemicals Co. has made the following appointments: **Dr. C. M. Blair**, superintendent of the new chemicals and resins plant to be constructed at Seadrift, Texas; **Harley M. Ross**, assistant works manager for the company; **John Conway, J. A. Field**, and **W. A. Woodcock** as assistant managers in the Fine Chemicals Div.

Fiber Glass Div., Libbey-Owens-Ford Glass Co., has opened a new district sales office at 1437 Statler Bldg., Boston, under the management of **Hilary H. Smart. George J. Hannes** has been named administrative assistant to **Herbert A. Fox**, technical manager of the division at Parkersburg, W. Va.

Hercules Powder Co. has appointed **Werner C. Brown** as an assistant director of sales for its Cellulose Products Dept. **A. R. Olsen** succeeds Mr. Brown as manager of CMC sales, and **J. B. Martin** replaces Mr. Olsen as manager of molding powder sales.

The Colton Chemical Co., 1545 E. 18 St., Cleveland, Ohio, has opened a new four-story building for the production of polyvinyl alcohol dry resin powder to be manufactured under the trade name Vinol. There will be two grades of Vinol—FH-400 and FH-500. FH-400 is a medium grade fully hydrolyzed type, while FH-500 is a high viscosity fully hydrolyzed type. The company claims it is one of the major producers of polyvinyl alcohol. It also produces polyvinyl acetate emulsions and dry beads as well as phenol formaldehyde solutions.

Colton has also just purchased the **Flotofoam Insulation Div.** from **U. S. Rubber Co.** Flotofoam is a urea formaldehyde foam used as insulation in such things as show case freezers, refrigerator cars, ice cream trucks, and the like, where its light weight makes it possible to reduce by at least 20% the space required for insulation. It is available in block, panel, and shredded form and will be available under the trade name Colfoam. It can be surfaced with paper, aluminum foil, cloth, or resin coatings. The new building for manufacturing Colfoam in Cleveland is at 6620 Union Avenue.

Bakelite Co., a Div. of Union Carbide and Carbon Corp., has announced a series of changes and promotions of company-wide scope. Part of these changes are printed herewith—the others will be printed next month with a complete listing of the company's newly rearranged sales organization, details of which are still in the making. Changes concerning the engineering and construction department are as follows:

R. B. Lowe, a vice president of Bakelite Co., is now in charge of engineering and construction in all plants, including Bound Brook, N. J.; Bloomfield, N. J.; Ottawa, Ill.; Marietta, Ohio; Bath, Me.; Belleville, Ont. (Canada); and the Halowax Products Plant at Wyandotte, Mich. He has been with Bakelite since 1923.

R. K. Turner has been appointed vice president in charge of production for Bakelite. He joined Carbide and Carbon Chemicals in 1924, was general superintendent of the South Charleston, W. Va., plant from 1940 to 1946, and since then has been affiliated with the Works Management Dept. in New York.

Harvey D. Shannon has been appointed manager of the Engineering and Construction Department. He has been works manager since 1945 and responsible for facilities at six of the above plants. He has been with Bakelite since 1917.

Glenn L. Pitzer has been appointed to succeed Mr. Shannon as works manager of the Bakelite Co. He joined Carbide and Carbon Chemicals Co. in 1933, was appointed superintendent of the Canadian Resins and Chemicals Plant at Shawinigan Falls, Quebec, in 1942, and since 1947 has been in charge of all resin manufacturing operations of the Texas City, Texas, plant of Carbide and Carbon Chemicals Co.

L. K. Merrill has been appointed vice president in charge of product and process development of Bakelite. He joined National Carbon Co., another division of Union Carbide and Carbon Corp., in 1920.

Albert E. Maibauer, who joined Bakelite in 1925, has been named assistant to the manager of the New York Sales Development Group of Bakelite and will continue his work on the development of fluorinated resins which he began in 1947.

PERSONAL

Thomas R. Simkins has been named branch manager at Detroit and will direct transportation sales

PLASTISCOPE

for **Glass Fibers, Inc.**, Toledo, Ohio. Mr. Simkins was formerly vice president of **Glasfloss Corp.**

Dr. Ralph Ball has been appointed technical director of the **Plastics Div., Celanese Corp. of America.** Dr. Ball has been with the firm for 21 years.

W. R. Eichelberger has been named to the post of general sales manager of the **Flexible Packaging Div., Shellmar Products Corp.**, Mt. Vernon, Ohio.

Ball & Jewell, Inc., 24-28 Franklin St., Brooklyn, N. Y., has named **Herman G. Baur** as sales manager. He succeeds **Dewey Rainville** who has resigned.

Edward V. Osberg has been named as general manager of **National Polychemicals, Inc.**, 131 Clarendon St., Boston, Mass., a newly formed organization which manufactures and sells specialty organic chemicals.

Andrew Rohman has joined the sales staff of **Stanley Sapery Co.**, located at 341 Madison Ave., New York 17, N. Y.

Lynn F. Hamilton has joined **Federal Tool Corp.**, 3600 West Pratt Blvd., Chicago, Ill., as assistant to the president. Mr. Hamilton was formerly associated with **Chicago Molded Products Corp.** and **Perfex Plastics, Inc.**

H. B. Gillespie has been named as director of marketing for **Cordo Chemical Corp.**, Norwalk, Conn. He will make his headquarters at the company's New York office at 230 Park Ave.

Dr. John G. Harrison has been appointed director of research and development for **Imperial Chemical & Plastics Corp.**, Cranston, R. I. Dr. Harrison was formerly associated with **Firestone Tire & Rubber Co.** and **National Automotive Fibres, Inc.**

T. V. Monahan, assistant treasurer of **Rohm & Haas Co.**, has been appointed Chief of the Chemicals Branch, Rubber, Chemicals and Drugs Div., Office of Price Stabilization. Mr. Monahan, who succeeds **Patrick Dowd** of **Monsanto Chemical Co.**, will serve in this capacity for six months in the Washington post.

E. C. Medcalf has been named head of the **Coal Tar Chemicals Dept., Calco Chemical Div., American Cyanamid Co.** Mr. Medcalf, who joined the division in 1933, succeeds the late Q. T. Dickinson.

Robert A. Riesman has been elected president of **Royal Electric Co., Inc.**, Pawtucket, R. I., manufacturer of insulated wire, electrical specialties, and decorative Christmas lighting devices.

William T. Kiessling has joined **Rubber Corp. of America**, Brooklyn, N. Y., as technical sales representative for the company's line of plasticizers. He was formerly with **Hercules Powder Co.**

W. Harry Jenks has been appointed as New England sales representative to the furniture industry for **Federal Leather Co.**, Belleville, N. J. Mr. Jenks, who has specialized in coated fabrics, has been with the firm for ten years.

Dr. Hilding V. Tornebohm was elected president of the International Organization for Standardization for three years at that group's recent General Assembly. Dr. Tornebohm has been vice president and technical director of Svenska Kullagerfabriken (SKF Industries), Gotenborg, Sweden, since 1941.

Col. Herbert Milwit has assumed command of the Engineer Research and Development Laboratories, Fort Belvoir, Va.

Charles A. Southwick, Jr., has been appointed as technical director in charge of research and development for **H. P. Smith Paper Co.**, 5001 W. 66 St., Chicago, Ill., manufacturer of flexible barrier materials. Mr. Southwick is the author of many technical articles and has made many contributions to packaging knowledge, including the Southwick method of testing water vapor transmission. During World War II he served on the War Production Board in various administrative capacities, and was instrumental in developing and improving packaging war materials. After the war he became research director of **Shellmar Products Corp.** and technical editor of *Modern Packaging* and "Modern Packaging Encyclopedia."

E. Bowman Stratton has resigned from **Industrial Radiant Heat Corp.** and has established a consulting office at Fairmont Rd., Long Valley, N. J. He specializes in thermoplastic sheet forming applications. Mr. Stratton is well known in this branch of the plastics industry as a pioneer in the development of the famous vacuum formed, pre-printed, rigid vinyl relief maps now being produced in large volume by the U. S. Army Map Service.

MEETINGS

Sept. 9-13—American Chemical Society, Seventh National Chemical Exposition, Chicago Coliseum, Chicago, Ill.

Sept. 11-13—American Institute of Chemical Engineers, Palmer House, Chicago, Ill.

Sept. 11-14—Packaging Machinery Manufacturers Institute, 20th Annual Meeting, Homestead, Hot Springs, Va.

Sept. 18-29—National Homefurnishings Show, Fourth Annual Exhibit, Grand Central Palace, New York, N. Y.

Dec. 3-5—Society for Experimental Stress Analysis, Annual Meeting and Exhibition, Hotel McAlpin, New York, N. Y.

Dec. 7-10—American Institute of Chemical Engineers, Annual Meeting, Hotels Cleveland (headquarters) and Carter, Cleveland, Ohio.

S.P.E. Meetings

Sept. 19—F. W. Reynolds, International Business Machines Corp., will address the Buffalo Section on "Plastics, A Cast History."

Oct. 17—Paul Elliott, Naugatuck Chemical Div., will speak to the Buffalo Section on "High Impact Styrenes and Copolymers."

Nov. 21—A. N. Skeels, Roll Leaf Stamping Co., will talk to the Buffalo Section about "Marketing of Plastics and Plastics Products."

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Cyanamid Stearates do many jobs, and do them well. For metal molding powders, cosmetics and drugs they act as excellent internal lubricants. For plastics and rubber, they are first-rate mold lubricants.

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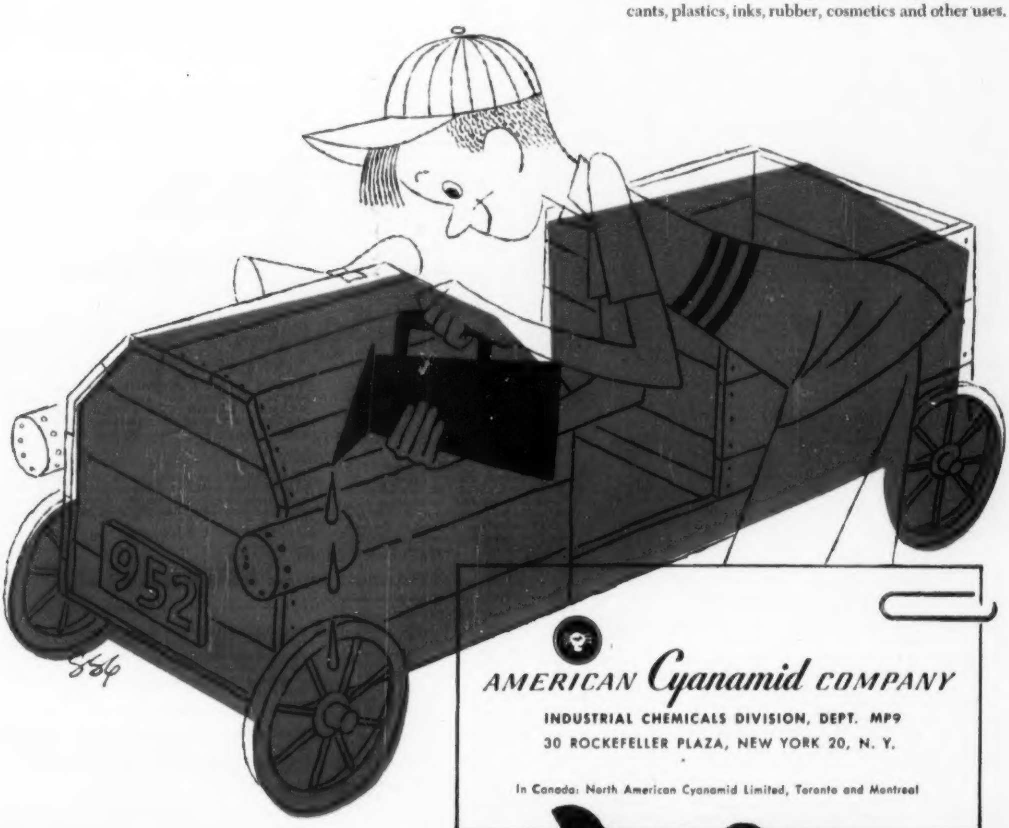


AMERICAN *Cyanamid* COMPANY

INDUSTRIAL CHEMICALS DIVISION, DEPT. MP9

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

In Canada: North American Cyanamid Limited, Toronto and Montreal

CLASSIFIED ADVERTISEMENTS

MODERN PLASTICS reserves the right to accept, reject or censor classified copy.

EMPLOYMENT • BUSINESS OPPORTUNITIES • EQUIPMENT (used or resale only)

MACHINERY and EQUIPMENT FOR SALE

FOR SALE: Quick delivery Rubber and Plastic Equipment. Farrel 16" x 48", and 15" x 36", 2 roll rubber mills. New 6" x 12" and 6" x 16" Lab. Mixing Mills and Calenders. Other sizes up to 84". Royle #1 to #3 extruders, Bethlehem 2000 Ton 10 opening press, 5'-6" x 8'-9" heated platens. 200 ton Brunswick 21" x 21" Platens, 14" Ram, Record Presses. W.S. 100 ton 24" x 24". Elms 75 ton 30" x 36". Also presses Lab. to 2000 tons from 12" x 12" to 48" x 48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump 250# W.P. W.S. 4 Plgr. High and low Pressure Hydr. Pump. HPM 5 GPM 2700 lbs. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Closed Steel ASME Pressure Tank 275 PSI, 1200 gals. Stokes Automatic Molding Presses. Rotary & Single punch Preform Tablet Machines ½" to 3". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins jacketed mixers 100, 50 & 9 gals. Ball & Jewell etc.; Plastic Grinders. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 90 West Street, New York 6, N. Y. WOrth 2-5745.

FOR SALE: 50 Ton Stokes Presses & Pump, 200 Ton W.S. Hobbing PRESS, 300 Ton W.S. PRESS 24 x 20 Platen, 175 Ton H.P.M. PRESS 30 x 30 Platen, 150 Ton Farrel PRESS 30 x 30 Elec. Plates. 140 Ton W.S. PRESS 23 x 17 Platens, 85 Ton Stewart Bolling PRESS 20 x 20 Platen, 50 Ton Elmes PRESS with 18 x 18 Elec. Plates, 75 Ton W.S. PRESS 15 x 15 Platen, 75 Ton Adamson PRESS 20 x 20 Platens. Laboratory presses, Accumulators, Piston and Oil Pumps. AARON MACHINERY CO., INC., 45 Crosby St., N.Y.C.

FOR SALE: Injection Presses: 8 & 24 oz. Watson, 9, 12 & 40 oz. HPM. 22 oz. Impco. 3 oz vert. Munton. 1 oz. Van Dorn. 1-9 oz. HPM cylinder.—Extruder: 40' conveyor, 10' Cooling trough. 4 scrap grinders. Ovens. 150 & 250 tons transfer presses. 250 tons laminating press. Preform presses. Sheridan Embossing press. 42" Johnstone Slitting & Rewinding machine. 7½ HP Reliance Varidrive. 3 HP Gas boilers. List your surplus equipment with me. JUSTIN ZENNER, 823 W. Waveland Ave., Chicago 13, Ill.

We handle hydraulic presses, pumps, and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. HYDRAULIC SAL-PRESS, INC., 386-90 Warren Street, Brooklyn 2, N. Y. MAin 4-7847.

FOR SALE: Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars address Box 1643 Modern Plastics.

FOR SALE: 8 oz. Watson-Stillman injection molding machine—toggle lock—oil gear pump. All new heaters. Reasonably priced as we need the space for other operations and are no longer in the plastic molding field. PACE CORP., 7047 E. Eight Mile Rd., Base Line, Mich. Telephone, Detroit—Jefferson 6-0222.

FOR SALE: 10 Elmes Hydraulic Presses, 30 ton capacity downward moving rams, 4 posts platens 14" x 10" daylight 13", $400 each; and 4 Burroughs Presses, 50 ton capacity downward, moving rams platens 18" x 17" daylight 28", $600 each. ERIC BONWITT, 431 So. Dearborn St., Chicago 5, Illinois.

SAVE WITH GUARANTEED REBUILT EQUIPMENT—RUBBER MIXING MILL, heavy duty 18"x48"; HYDRAULIC PRESSES: 28"x25" 18" ram, 400 tons; 36" x 36" 16" ram, multiple opening, 250 tons; 37" x 37" 30" ram, multiple opening 1060 tons; 20" x 20" 10" ram, 200 tons; 22" x 15" 8" ram, 75 tons; 14" x 14" 8" ram, 75 tons; 12" x 12" 8" ram, 75 tons; 19" x 24" 10" ram, 78 tons; 18" x 16" 7½" ram, 60 tons; 12" x 12" 7½" ram, 60 tons; 14" x 14" 8" ram, 50 tons; 12" x 12" 6½" ram, 50 tons; 8" x 9½" 4½" ram, 20 tons; 16" x 16" 3½" ram, 12 tons; LABORATORY PRESSES: 10 ton 6" x 6" Carver, 20 ton 8" x 8" Carver; NEW UNIVERSAL DUAL PUMPING UNITS: 3 to 15 HP; NEW LABORATORY MILLS & CALENDERS: Extruder: Royle #1 Plastic, insulating type; ACCUMULATOR: HPM 6" ram 2500#; Preform Presses all sizes, also Mixers, Vulcanizers, Injection Molding Machines, etc. UNIVERSAL HYDRAULIC MACHINERY CO. INC., 285 Hudson Street, New York 13, N. Y.

RUBBER MILLS: 2—Farrel-Birmingham 18" x 42" 13½" bearings, with a 75 H.P. sync. motor. 1—Calender 6" x 12", w.c. rolls motor driven. DALTON SUPPLY CO. 2829 Cedar St., Phila. 34, Pa.

FOR SALE: Ten Model 248-2 Singer Electronic Seamers, complete with oscillators and transmitters, for bonding thermoplastic materials. Less than 600 hours' use; excellent condition; available immediately. THE CREST MANUFACTURING COMPANY, 5735 Cass Ave., Detroit 2, Mich.

FOR SALE: Thermex Preheater, Model 2P; Airtronics Preheater, Model D E; Airtronics Preheater, Model C B. Like new. AARON MACHINERY CO., INC., WOrth 4-8233, 45 Crosby St., New York 12, N. Y.

FOR SALE: 1 Ball & Jewell No. 1½ Rotary Cutter, stainless steel construction, with 30 HP motor. Also Kux and Stokes Rotary Pellet Presses. PERRY EQUIPMENT CORP., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: Kux Preform Press—Model #60—5 H.P. G.E. motor—Reeves Vari-drive. 3—Ingersoll-Rand Impact Wrenches size 508. Make offer or write for particulars: INGWERSEN MANUFACTURING CO., INC., 1800 So. Acoma, Denver, Colorado.

FOR SALE: 1—22" x 60" 2 Roll Compounding Mill, 150 HP synchronous motor; 1—16" x 42" mill with 75 HP motor; 1—2" oil heated plastics Extruder, motor driven; 1—Colton #5½ Preform Machine. Also Grinders, Extruders, Compression and Injection Molding Presses, Mixers, etc. Send us your inquiries. CONSOLIDATED PRODUCTS CO., 13-14 Park Row, New York 38, N. Y.

FOR SALE AT TREMENDOUS SAVINGS: Colton 2 and 3 RP Rotary Tablet Machines. Mikro 1SH, 3TH, 4TH Pulverizers; Jay Bee and Schutz O'Neill Mills. Baker Perkins & Readco Heavy Duty Steam Jacketed, Double Arm 50, 100, 150 gal. Mixers. Baker Perkins 150 gal. D. A. Unidor Jacketed Mixer. Baker Perkins 100 gal. D. A. Vacuum Mixers. J. H. Day from 8 up to 75 gal. Imperial and Cincinnatus D. A. Jacketed Sigma Blade Mixers. Day & Robinson 100 up to 4000 lbs. Dry Powder Mixers. Pony ML and M Labelrites. Package Machy. FA, FA4, Miller, Hayssen 3-7, 4-10, 7-13, Scandia auto. Wrappers. Hudson Sharp 2W6 Campbell Wrapper. REBUILT AND GUARANTEED. This is only a partial list. Over 5000 machines in stock—available for immediate delivery. Tell us your machinery requirements. UNION STANDARD EQUIPMENT CO., 318-322 Lafayette St., New York 12, N. Y.

MACHINERY and EQUIPMENT WANTED

WANTED: Plastics and Rubber Processing Machinery including Banbury Mixers, Heavy Duty mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider a set up plant now operating or shut down. When offering give full particulars. P.O. Box 1351, Church Street Sta., New York 8 N. Y.

WANTED: New or used 2½" or 3¼" N.R.M. extruders. Also parts such as cylinders, etc. Reply Box 1644, Modern Plastics.

WANTED: Extruder—used: Please give size condition, price and location. Reply box 1647, Modern Plastics.

WANTED: 1 60" rubber mill complete and 1 3A Banbury complete. Good Condition. Required for plastic manufacturing plant. No dealers. Reply Box 1656, Modern Plastics.

WANTED: 9, 12 or 16 oz. Injection Molding Machine in guaranteed condition. HPM preferred. Reply Burwood Products Company, P.O. Box 306, Traverse City, Michigan.

WANTED: Midwest molder needs used plastic scrap grinder. Prefer B. & J. Ideal or Cumberland Model O. Will also buy one or two Reed-Prentice Injection Molding Presses, 16 oz. and 24 oz. Reply Box 1662, Modern Plastics.

MATERIALS FOR SALE

FOR SAL[illegible] pounds Flesh and Pink Butyrate Mold[illegible]owder, reground 28 cents per pound. Reply Box 1645, Modern Plastics.

NYLON extruded monofilament—black—available in .022" and .028" gauge, original Dupont packing. PERFORATED FIBEROK laminated plastics sheet stock, in numerous patterns and gauges. Reply Box 1659, Modern Plastics.

PLEXIGLAS skeleton scrap for sale, cast, clear transparent, uncontaminated, substantial quantities, continuous supply. Germanow-Simon Machine Co., Inc., 408 St. Paul St., Rochester 3, N. Y.

MATERIALS WANTED

WANTED: PLASTIC Scrap or Rejects in any form. Acetate Butyrate, Polystyrene, Acrylic, Vinyl Polyethylene, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding, magnetizing and compounding. Reply Box 1641, Modern Plastics.

WANTED: PLASTICSCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic, Ethyl Cellulose. Reply Box 1642, Modern Plastics.

VINYL FILM SHEETING wanted, 3½" gauge, reprocessed, clear. For prompt payment mail samples, prices. Reply Box 1650, Modern Plastics.

(Continued on page 224)

CLASSIFIED ADVERTISING
(Continued from page 224)

WANTED: Plastic scrap such as Cellulose Acetate, Vinyls, Acrylic, Ethyl Cellulose, Polystyrene, Butyrate, etc. We also buy surplus inventories of molding powder or grind, clean and reprocess your own scrap. CLAUDE P. BAMBERGER, INC., 152 Centre St., Brooklyn 31, N. Y., Tel. Main 5-5553. Not connected with any other firm of similar name.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate, Custom grinding, magnetizing, compounding, and straining of contaminated plastics. FRANKLIN JEFFREY CORPORATION, 1671 McDonald Avenue, Brooklyn, N. Y., ES 5-7943.

WANTED: NITRATE SCRAP—.010 plastic scrap in any form, sheets or rolls to as narrow as 1¾" wide. Due to storage and fire restrictions would prefer to buy in quantities of ten to fifty pounds. Address B & J SPECIALTIES CO., 1265 Harrison St., Noblesville, Ind.

MOLDS FOR SALE

FOR SALE: Patented cigarette and match case. Highest quality hobbed injection mold suitable for 8 ounce Reed Prentice press. Molds 5 tops and 5 bottoms each cycle. This is a real opportunity for firm with distribution in the advertising novelty or tobacco accessory field. Write H. L. Auten, 117 Carrol Ave., East Peoria, Illinois.

MOLDS WANTED

MOLD WANTED for injection molding. We will buy one mold or a complete line or series of molds for finished resaleable items. Housewares, toys, novelties, etc. Will also buy molds for industrial parts such as handles, knobs, drawer pulls, gears. All items for resale in U. S. A. Send detailed information to VICTORY MANUFACTURING COMPANY, 1722 W. Arcade Place, Chicago 12, Illinois.

WANTED USED INJECTION MOLDS of toys and novelties, handles and knobs, and ladies' and men's buttons, to be used in 4 oz. machines. Kindly send samples and quotations by Air Mail to Post Office Box 1471, Karachi 2, Pakistan.

INTERESTED IN MOLDS to produce thimbles and thread caddy. Will buy outright. Please give full description, price and all necessary information in first letter. Reply Box 1651, Modern Plastics.

TITLE ACCESSORY MOLDS WANTED. Injection molds for Bullnose Cap, Outside Corner, and Cove Base. Advise number of cavities, age, price and condition. Submit samples of sections. Reply Box 1653, Modern Plastics.

BRUSH MOLDS WANTED FOR CASH: Injection molds for ladies', men's, military, nail, tooth, brushes, etc. Send particulars and samples. Box 667, Realservice, 110 West 34th St., N.Y.C.

HELP WANTED

VINYL PLASTICS. One of America's largest manufacturers of unsupported vinyl plastic film is seeking the services of a thoroughly experienced PRODUCTION MANAGER, who is familiar with all phases of compounding & calendering of vinyls. Must have wide plant experience & be able to institute & follow up procedures which will lead to highest productivity & efficiency. Familiarity with quality control essential. Excellent oppty for right man with unlimited opportunity for advancement. State education, background & experience. All information submitted will be kept strictly confidential. Our employees know of this Ad. Reply Box 1648, Modern Plastics.

DEVELOPMENT MANAGER—Progressive and expanding plastics manufacturer has important opening for a Development Manager with several years experience compounding all types of thermosetting molding compounds and industrial resins. Please submit detailed resume and state salary desired. Reply Box 1646, Modern Plastics.

FACTORY MANAGER—VINYL PLASTIC FLOORING: Nationally-famous manufacturer has opening for factory manager or assistant. Excellent opportunity for advancement with a company that enjoys a top reputation in the floor covering field. The man we seek must be thoroughly familiar with all phases of manufacturing vinyl plastic flooring. Experience with rubber flooring manufacturing helpful but not essential. Write, giving full details of past experience, personal data and salary desired. All replies will be held in strictest confidence. Reply Box 1649, Modern Plastics.

PLASTICS CHEMIST: Chemist required by well-established New England plastics manufacturer to assume charge of Works Laboratory. Three to five years' experience in use of vinyl and related resins desirable. Submit detailed resume of experience and training together with salary requirements in first letter. All answers will be held in confidence. Reply Box 1660, Modern Plastics.

FILM TECHNICAL REPRESENTATIVE: New company in Massachusetts making calendered film offers that once-in-a-lifetime chance for 3 capable salesmen to get in on the ground floor and grow with the company. Must be hard working and capable of taking management of territory. State experience and income requirements. Reply Box 1664, Modern Plastics.

EXTRUSION SALESMAN: Growing Boston plastics company has unusual opportunity for a few men to handle sales of thermoplastic extruded products in New York and other parts of the country, either on full time or part time basis. Commission or Salary. State experience and availability. Reply Box 1665, Modern Plastics.

PLASTICS LABORATORY SUPERVISOR WANTED—A plastics laboratory supervisor with several years of wide experience in various molding processes. A basic knowledge of high polymer chemistry desirable. Work includes development of molding processes for new plastics, testing, and supervision of a small molding shop. Write to Personnel Department, Los Alamos Scientific Laboratory, University of California, P. O. Box 1663, Los Alamos, New Mexico.

PLASTICS EXTRUSION SALESMAN—Large midwest plastics manufacturer desires services of experienced man with following . . . Draw against commission . . . Full Company benefits . . . Unlimited earning possibility . . . Replies confidential. Reply Box 1655 Modern Plastics.

PLASTIC CHEMIST—Large west coast floor covering manufacturer has opening in Research Department for chemist experienced in industrial application of high polymers. Experience in vinyl resins including paste types essential. Send complete experience resume including photograph and salary expected. Reply Box 1654, Modern Plastics.

FOREMAN: Small insulating plant located in mid-south will employ man to take charge of plant. Must have complete knowledge of plastic extruding, braiding, and weatherproofing departments. This is a good opportunity for the right man to get in on the ground floor of a fast expanding company. Salary open. Give all information in first letter. Reply Box 1666, Modern Plastics.

AN EXCELLENT OPPORTUNITY FOR AN ENGINEER who has had experience in aircraft glazing and thermoplastic fabrication. Salaried compensation is substantial, with an incentive plan available. STEINER PLASTICS, Pratt Oval, Glen Cove, Long Island, N. Y. GLencove 4-6400.

SALES AGENT WANTED: Midwestern Extruder and Fabricator, well established, desires representation in New York City and Metropolitan area. Would also consider a change in Chicago sales representation. Send resume of background and reply Box 1657, Modern Plastics.

PLASTICS ENGINEER: Excellent job opportunity for graduate engineer with specific experience in low pressure moulded plastics utilizing fiberglas and polyester resins. Will do estimating on laminates, honeycomb sandwich, foam and preform types of products; will also work closely with development and production departments and make customer contacts. This is a permanent position with a firm that has been in business for 107 years. Our plastic division is expanding and we want a man who can grow with it. Good living and working conditions — exceptional employee benefits. Write details of experience and education to Personnel Manager, THE BRUNSWICK-BALKE-COLLENDER COMPANY, Marion, Virgina.

WANTED: Jr. Plastic Engineer for mold design and estimating. Old established Chicago concern. Give details and background. Reply Box 1658, Modern Plastics.

REPRESENTATIVES WANTED: Company manufactures complete line of products for the plastic industry. Materials also used by glass, aircraft, mirror and many other fields. Excellent opportunity for right man to take part in this fast-growing industry. Reply Box 1661, Modern Plastics.

WANTED: Salesman for custom injection molding by established New England firm, having tool room facilities, assembling facilities and spraying equipment. Reply Box 1663, Modern Plastics.

SITUATIONS WANTED

CHEMICAL ENGINEER with six years experience in all phases of vinyl plastics calendering, extruding, coating and printing. Have held responsible position as technical director and production manager in small vinyl film plant. Four years experience development with large manufacturer. Coated fabrics, film, and sheeting processing and formulation, also new products work. Interested any phase. Reply Box 1667, Modern Plastics.

MISCELLANEOUS

INJECTION MOLDERS, 20,000 sq. ft. available for lease! Contains celluloid permit & vault. Room for 15 machines. Assembly, fabrication & storage areas. Water & power lines installed. Excellent labor market. N.Y.C. Box 469, Realservice, 110 W. 34 St., New York 1, N. Y.

WANTED: BOXES, BOXES — Molded Boxes or Box Molds: We have thousands of clients who are seeking molded Styrene Boxes for packaging. List and send sample of each type box you have available. Bradley Associates, Inc., "world's largest source for molded plastic boxes" — 1652 N. Damen Ave., Chicago, Ill.

LICENSED FABRICATORS WANTED: to handle distribution and fabricate to customer's order new industrial plastic used in chemical, plating, food processing, electrical and other industries. Material is a rigid thermoplastic supplied in semi-finished shapes and sheets—can be fabricated, machined, welded and cemented with ordinary techniques. Material has proven potential and is backed up by national advertising campaign. Fabricator-distributor must have successful record in plastics industry — representatives wanted in all parts of country, including south, southwest, northwest and central states. Please write full details to Box 1668, Modern Plastics.

All classified advertisements payable in advance of publication

Up to 60 words $10.00	Up to 120 words $20.00	Up to 180 words $30.00
Up to 60 words (boxed).. $20.00	Up to 120 words (boxed).. $40.00	Up to 180 words (boxed).. $60.00

For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

INDEX OF ADVERTISERS

SEPTEMBER 1952

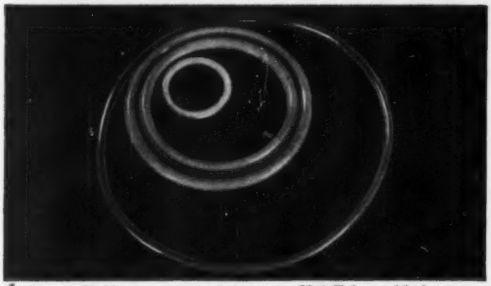
(*Continued on page 228*)

KEL-F

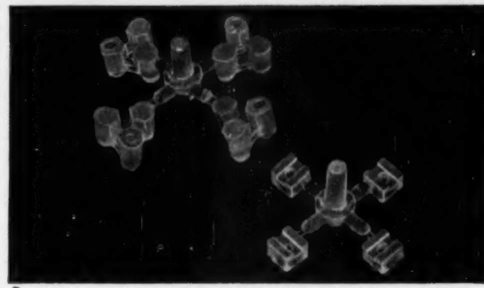
ONLY COMMERCIAL FLUORO-CHLORO-CARBON THERMOPLASTIC

Application Report #3

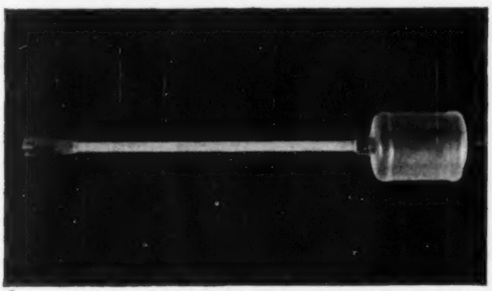
. . . how the unique thermoplastic — TRIFLUORO-CHLORO-ETHYLENE — has [illegible]



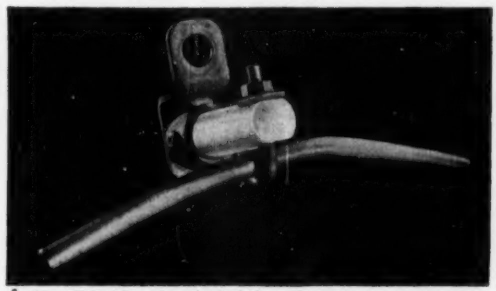
1. These "O" Rings are unusual because Kel-F is molded over a resilient core to provide high corrosion resistance in applications requiring either static or dynamic seals. Kel-F's chemical inertness, its high temperature properties and ready moldability combine to meet the specs for these small but extremely vital pump and compressor parts.



2. A Kel-F exclusive among fluorocarbon-type materials... production molding *by injection.* Indicative of hundreds of similar parts, these components are shown here complete with sprue and runners. Such Kel-F pieces have myriad uses where high dielectric strength, zero water absorption, corrosion resistance and high temperatures are involved.



3. This metal float would be safe even in aqua regia because a dispersion of Kel-F has been applied over its entire outer surface. Kel-F dispersion-coated parts — such as this liquid level gauge float — are currently solving many equipment problems involving corrosives. Kel-F dispersions are available in two basic formulas.



4. When dielectric and mechanical strength must be combined, as in this UHF aerial support, Kel-F extruded and molded rod is a natural specification. In addition to having excellent characteristics in both dielectric and mechanical categories, Kel-F retains those properties over an extreme temperature range of some 700 degrees—from minus 320F to 390F.

A Capsule Report on the Properties of KEL-F

- ★ Chemical Inertness
- ★ Wide temperature range —minus 320 F to 390 F
- ★ High electrical resistance
- ★ Low Cold Flow
- ★ Zero Moisture Absorption
- ★ Variable transparency and flexibility properties
- ★ Readily molded, extruded and machined

Basic Kel-F Products Available

MOLDING POWDERS

Unplasticized

- #300 for high temperature service
- #270 for less severe temperatures

Plasticized *(in either #300 or #270)*

- P 20 with 20% plasticizer
- P 25 .. " 25% "
- P 30 ..•" 30% "

DISPERSIONS

- NW-25 flows readily at fusion temperatures
- N-1 High molecular weight

OILS, WAXES and GREASES

- #1 Light Oil
- #3 Medium Oil
- #10 Heavy Oil
- #40 Waxy Oil (pour point 80-90 F)
- #150 Hard Wax at 70 F

(Greases compounded to order)

Standard Fabricated Kel-F Materials and Parts Available from Commercial Sources

Molded Sheets ★ Extruded and Molded Rod ★ Extruded Tubing
Thin Film (extruded as lay-flat tubing) ★ Strip
Gaskets ★ Washers ★ Valve Discs ★ "U" Packing
"O" Rings ★ Kel-F coated Resilient-core "O" Rings
Valve Diaphragms
Transformer Terminals ★ Rotary Electric Switches ★ Hook-up Wire
Electronic Terminals, Tube Bases and Coil Forms

For full information on various molders, extruders and fabricators of Kel-F products; also technical data on detailed properties, molding and application techniques — write

KELLOGG

Chemical Manufacturing Division

THE M. W. KELLOGG COMPANY

P. O. Box 469,
Jersey City 3, N. J.

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(Continued from page 226)

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Each month, the Readers' Service Department of MODERN PLASTICS answers scores of questions for our readers. Questions range from simple requests for information about the manufacturer of a stock molded item to requests which demand detailed, technical answers.

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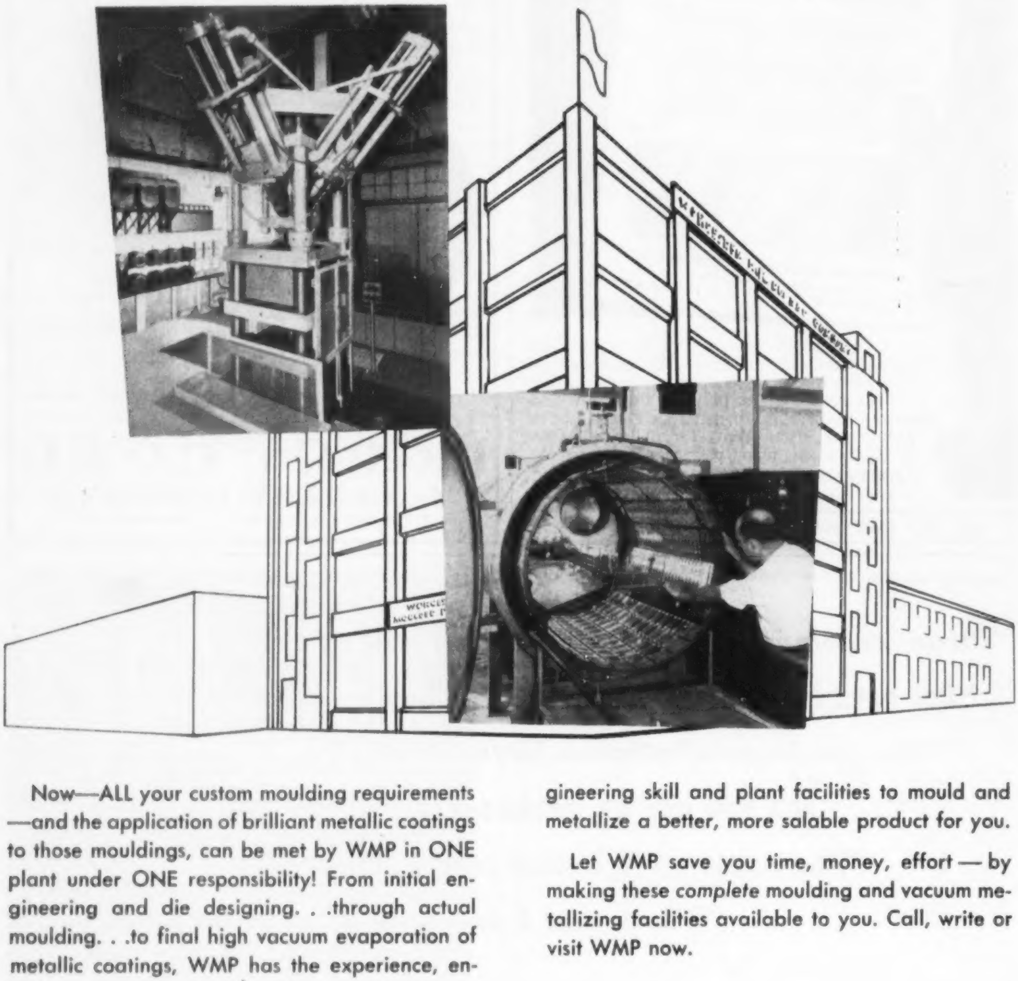

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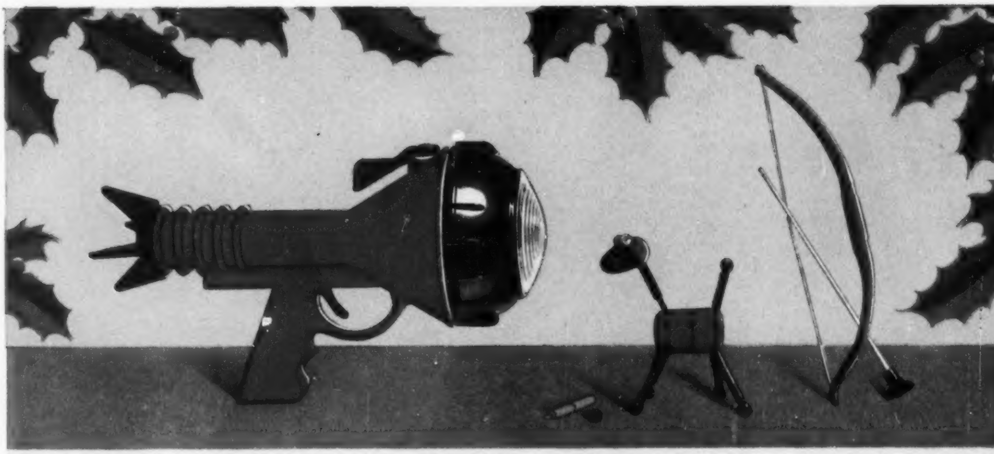
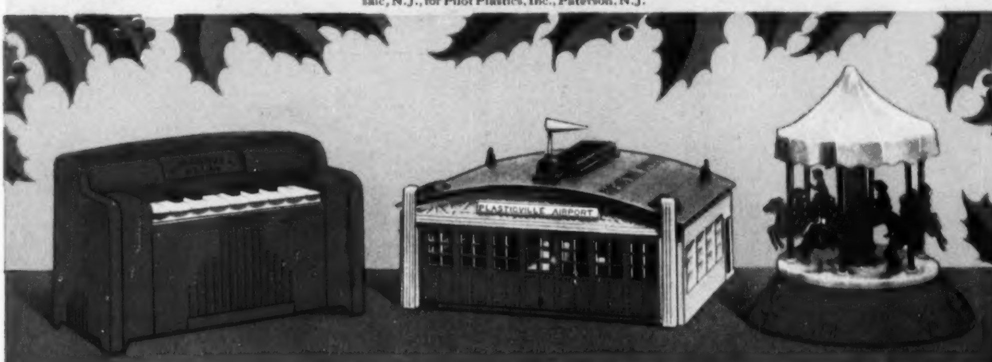


"Space ray gun" is molded entirely of BAKELITE Styrene Plastic. Powered by flashlight batteries, it flashes red, white, green light through its clear polystyrene lens. Made by Ideal Toy Co., Hollis, N. Y.

With the Galupee Action Toy, children can put pieces of BAKELITE Styrene Plastic together to create their own toys. Pieces must fit one another tightly, withstand juvenile wear and tear. Molded by Arrow Plastics Co., Passaic, N.J., for Pilot Plastics, Inc., Paterson, N.J.

"Big Chief" bow and arrow set has a strong, flexible, colored bow molded of BAKELITE Styrene Plastic. It's designed to propel arrows 50 feet. Made by Aurora Plastics Corp., Brooklyn, N. Y.



The Magnus super "blow organ" has reeds, keys, and case made of BAKELITE Styrene Plastics for simplified production, compact design, good appearance. Made by Magnus Harmonica Corp., Newark, N. J.

Airport hangar for "Plasticville, U.S.A." is made to authentic scale, has fine details, comes disassembled. Accurately molded sections of BAKELITE Styrene Plastic quickly fit together. Made by Bachmann Brothers, Inc., Philadelphia, Pa.

Merry-go-round intricately molded of BAKELITE Styrene Plastic also has styrene plastic riders moved up and down by styrene plastic cams. A music box provides motive power. Molded by Cowan-Boyden Corp., Providence, R. I., for F.B.A. Industries, New York, N. Y.

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